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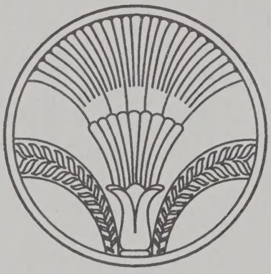

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TELEOMORPH OF SPHAEROTHECA PANNOSA ON DAHURIAN ROSE IN KOREA

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ABSTRACT: The teleomorph of *Sphaerotheca pannosa* on *Rosa* spp. has rarely been found only in the western world, but not in oriental countries. However, the present author collected it on *Rosa davurica* in Korea and made a detailed description and illustration. This is the first record for the perfect state of *S. pannosa* on *Rosa* spp. in the oriental world.

Keywords: *Sphaerotheca pannosa*, rose mildew, teleomorph

Sphaerotheca pannosa (Wallr. : Fr.) Lév. is a powdery mildew fungus infecting various species of *Rosa*. It is one of the most important pathogens causing reduced production and poor quality of roses in gardens and greenhouses. Though several species of *Prunus* have been recorded as natural hosts of this fungus, it is still unclear whether *Prunus* mildew is identical to rose mildew or not. Therefore, in plant pathology, rose mildew is treated as *S. pannosa* f. sp. *rosae* and *Prunus* mildew as *S. pannosa* f. sp. *pruni* (Agrios, 1997).

Since Wallroth (1819) first recorded the perfect state of this species, there have been several additional records on the rare occurrence of ascocarps on *Rosa* spp. in the western world, including USA (Salmon, 1900; Coyier, 1961; Junell, 1967; Price, 1969). On the other hand, no ascocarps of this species have been found in oriental countries. In Japan, Homma (1937) confessed that the perfect state of this species has not been collected in spite of the careful search for several years. Nomura (1997), who collected 55,000 specimens of powdery mildews in Japan, also failed to find the perfect state on *Rosa* spp. Zheng & Chen (1987) in China recorded the teleomorph of *S. pannosa* from *Prunus persica*, but not from *Rosa* spp. The author of this

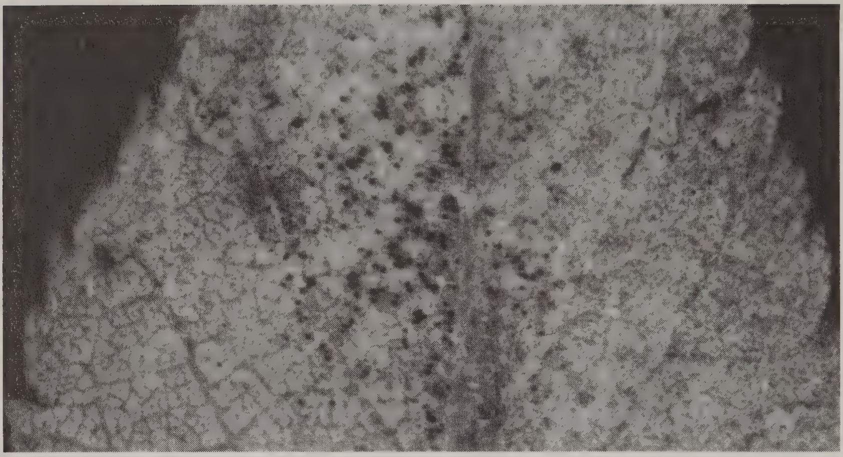

Fig. 1. Ascocarps formed on the lower leaf surface of *Rosa davurica.*

paper could also not find it during field trips in Korea in the last 17 years. The reason for the absence of ascocarps of *S. pannosa* on *Rosa* spp. in the oriental world is, however, unknown.

In Korea, *S. pannosa* is very common on cultivated roses and also on *R. multiflora* (wild rose) and *R. rugosa* (Shin, 1997). No teleomorph of this species has been found in Korea despite the fact that the anamorph occurs every year. In October 1998, however, the present author found ascocarps of *S. pannosa* on dahurian rose (*Rosa davurica* Pall.), cultivated as medicinal crop in Korea (Fig. 1).

The morphological characteristics of *S. pannosa* collected on *R. davurica* are as follows: On leaves and occasionally on young herbaceous stems. Ascocarps partly immersed in the mycelial layer, amphigenous, but mostly hypophyllous, scattered to somewhat gregarious, 75 ~ 95(~ 110) ㎛ diam., dark brown, wall-cells irregularly polygonal to rounded, ca. 10 ~ 20 ㎛ wide; appendages in the lower half, mycelioid, simple, interlaced, uniform in width, 4 ~ 6 ㎛ wide, variable in length, usually 0.3 ~ 3 times the diameter of ascocarps, 1 ~ 3(~ 4)-septate, basal septum 10 ~ 20 ㎛ away from the base, smooth throughout, moderately thick-walled throughout, usually becoming thin-walled at the apical portion, pale brown at the base and becoming hyaline upwards. Ascus one per ascocarp, 80 ~ 105 × 58 ~ 75 ㎛, rarely up to 150 × 85 ㎛, usually longer than the diameter of ascocarps, possibly due to swelling in water, oval to fusiform, hyaline, thin-walled, thinner at both ends. Ascospores eight per ascus, ellipsoidal, 22 ~ 28(~ 33) × 16 ~ 20 ㎛ (length/

width ratio=1.3 ~ 1.6), subhyaline due to dense cytoplasm and minute oil drops.

These morphological characteristics of the Korean collection are in general agreement with previous records from the western world (Fig. 2, Table 1). The larger dimensions of asci and ascospores in the Korean collection are possibly due to the fact that the present collections examined are fresh and fully mature, whereas the previous records are based on the dried herbarium specimens. Since this fungus produces secondary mycelium, often interlaced with appendages, it is known to be difficult to diffenentiate them due to similarities in their morpholgy and width, but mature appendages are usually brown, have a septum at the base, and the walls are thinner than those of the secondary mycelium (Fig. 2). Therefore, it was not so difficult to differentiate them by crushing the ascocarp under a low-power microscope.

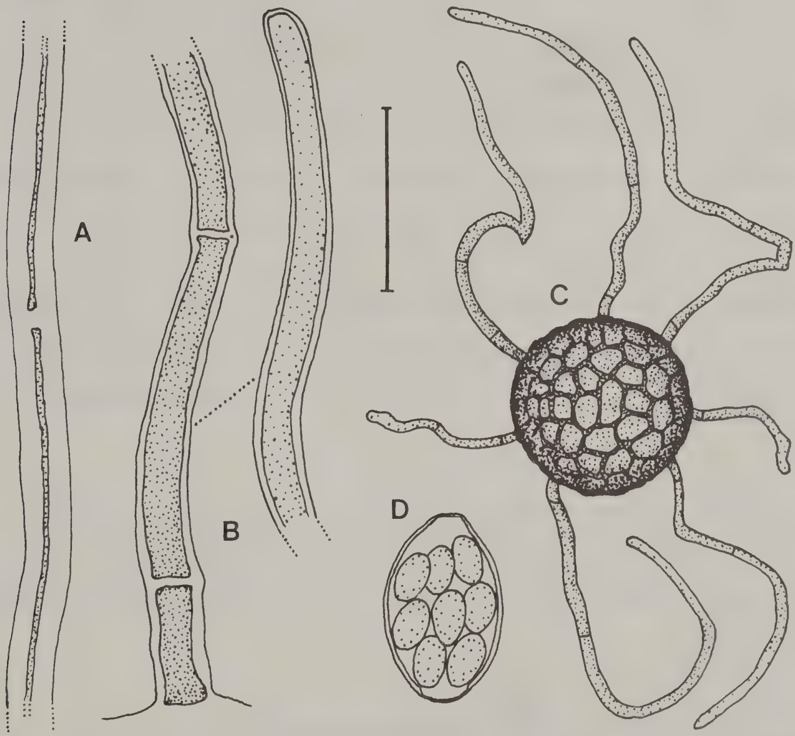

Fig. 2. Morphological characteristics of *Sphaerotheca pannosa* from *Rosa davurica.* (**A**) Secondary hypha with cell wall thicker than in ascomatal appendages. (**B**) Appendage. (**C**) Ascocarp with appendages. (**D**) Ascus containing 8 ascospores. Scale bar = 20 ㎛ for **A**-**B** and 100 ㎛ for **C**-**D**.

Table 1. Comparative morphology of the teleomorph in *Sphaerotheca pannosa* on *Rosa* spp. recorded by several researchers

Characters	Author	Salmon(1900)	Mukerji(1968)	Braun(1987)
Ascocarp				
diam.(㎛)	75-95(-110)	85-120	80-120	70-115
wall-cells	irr. polygonal to rounded	obscure	obscure	irr. polygonal to rounded
Appendage				
type	mycelioid	mycelioid	mycelioid	mycelioid
length*	0.3-3 ×	very short	less than 1 ×	0.5-2 ×
width(㎛)	4-6	ND**	ND	3-8
cell walls	mod. thick	ND	ND	thin or mod. thick
septation	1-3(-4)	septate	septate	septate
color	base brown, apex hyaline	pale brown	hyaline to pale brown	base brown, apex hyaline
Ascus				
Number	1	1	1	1
size(㎛)	80-105 × 58-75	100 × 60-75	80-100 × 60-75	70-100 × 50-80
Ascospore				
number	8	8	8	(4-)8
color	subhyaline	hyaline	hyaline	ND
size(㎛)	22-28 × 16-20	20-27 × 12-15	20-35 × 14-20	16-28 × 9-18

* Length of appendages is expressed as times of the diameter of ascocarps.
** ND = not described.

This is the first report on the occurrence of the teleomorph of *S. pannosa* on *Rosa* spp. in the oriental world. Since most of the powdery mildews are known to be heterothallic (Spencer, 1978; McGrath, 1994), unequal distribution of mating types may partly be the reason for the rare occurrence of ascocarps.

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ANGULAR LEAF SPOT DISEASE OF SAURURUS CAUSED BY PHAEORAMULARIA SAURURI COMB. NOV.

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ABSTRACT

A leaf spot disease of *Saururus cernuus* was recently observed in Florida, U.S.A. The causal organism proved to be a species of *Phaeoramularia*, identical to the fungus on the type specimen of *Cercospora saururi*. A new combination in *Phaeoramularia*, *P. saururi* is therefore proposed for the latter fungus. This species is contrasted and shown to be distinct from *Pseudocercospora saururicola*, which is known to occur on similar leaf spot symptoms on *Saururus* in Taiwan.

INTRODUCTION

An unknown cercosporoid leaf spot disease was recently observed on leaves of *Saururus cernuus* L. in Florida, U.S.A. (Figs. 1, 2). Presently, two cercosporoid species are known from this host, namely *Pseudocercospora saururicola* Goh & W.H. Hsieh, and *Cercospora saururi* Ellis & Everh. Chupp (1954) treated the latter two species as being synonymous, while Hsieh

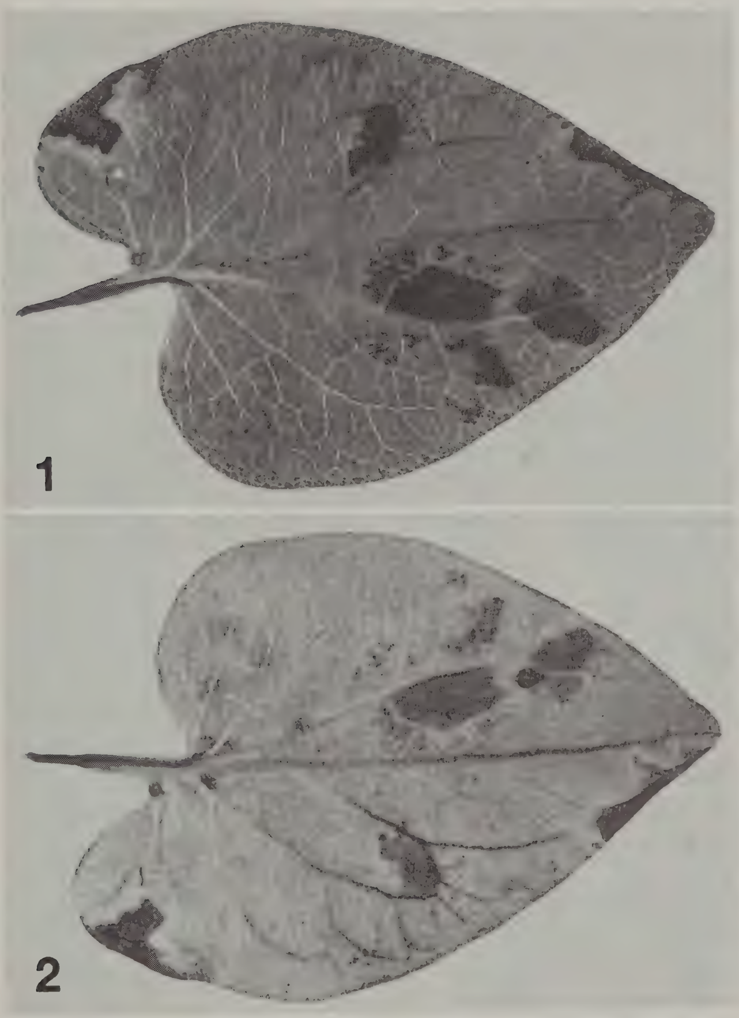
& Goh (1990) also considered them to be similar. The aim of the present study was to describe the cercosporoid fungus causing the leaf spot disease of *Saururus* in Florida, and to contrast it with the type specimens of the other two taxa discussed above.

TREATMENT OF SPECIES

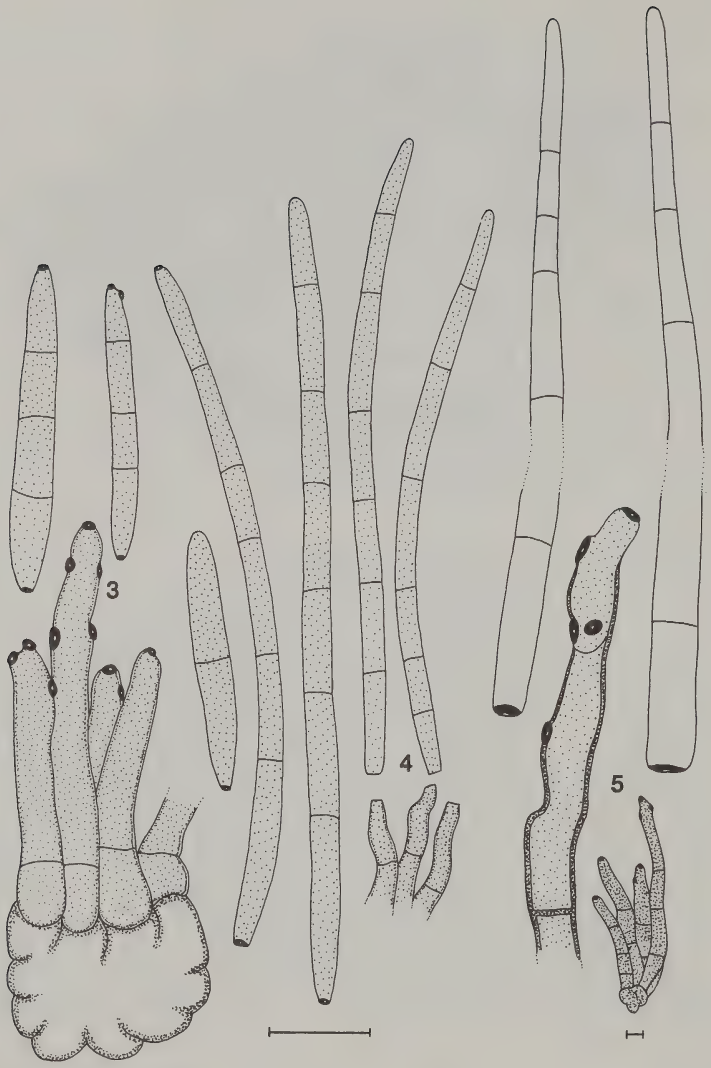
Phaeoramularia saururi (Ellis & Everh.), Crous & El-Gholl, comb. nov. Figs. 1-3

≡ *Cercospora saururi* Ellis & Everh., J. Mycol. 3: 14. 1887.

Leaf spots initially dark maroon to black in color with reddish margins, angular to irregular, 1-10 mm diam. Upon maturing, spots may coalesce into blotches with the centre sometimes becoming lighter as the tissue becomes dry and necrotic. Tip and marginal necrosis may also occur. *Mycelium* internal, composed of smooth, branched, hyaline hyphae, 2-3 µm diam. *Caespituli* fasciculate, hypophyllous, brown, up to 50 µm wide and 70 µm high. *Conidiophores* aggregated in loose to dense fascicles, arising from the upper cells of a brown stroma up to 30 µm wide and 20 µm high; conidiophores medium brown, smooth, subcylindrical, 1-3-septate, straight to slightly curved, unbranched, 35-50 x 3-5 µm. *Conidiogenous cells* terminal, unbranched, light brown, smooth, tapering to rounded apices with flattened, thickened, darkened, refractive loci, proliferating sympodially, 20-25 x 3-4 µm. *Conidia* catenulate, chains simple or branched, pale olivaceous, smooth, sometimes guttulate, subcylindrical, apex subobtuse, base long obconically truncate, straight to curved, 1-8-septate, (20-)60-90(-150) x (2-)3-4 µm; hila darkened, refractive, thickened; conidia 18-100 x 3-5 µm *in vitro*. Colonies dark red to red-brown, erumpent, with sparse to no aerial mycelium and smooth, irregular margins on 2% malt extract agar (MEA; Biolab, Midrand, Jhb., South Africa); a diffuse red pigment becomes visible in the agar with time. Cardinal temperature requirements for growth (in 5°C intervals), above 10°C minimum, 25°C optimum, and below 35°C maximum. Colonies reached 15 mm in diameter at 25°C on MEA after 8 days in the dark.



Figs. 1, 2. Angular to irregular leaf spots of *Phaeoramularia saururi* on the adaxial (Fig. 1) and abaxial (Fig. 2) leaf surface of *Saururus cernuus*.



Figs. 3-5. Conidiophores and conidia. Fig. 3. *Phaeoramularia saururi* (BPI 419211). Fig. 4. *Pseudocercospora saururicola* (BPI 441031). Fig. 5. *Cercospora* sp. (BPI 441030). Bars = 10 µm.

Specimens examined: U.S.A., Louisiana, on leaves of *Saururus cernuus*, A.B. Langlois No. 599, 27 Jul. 1886, BPI 419211 (holotype); Eustis Lake County, on *S. cernuus*, G.V. Nash, Jun. 1895, No. 2006, BPI 441015; Florida, Alachua County, S.E. Walker, 16 Jul. 1998, culture STE-U 2221, P98-2535; D.C., Chain Bridge, on *S. cernuus*, D.G. Fairchild, 15 Oct. 1890, ex HBG; Canada, Ontario, London, J. Dearness, 1893, Ellis & Everh. Fungi Columbiani 94, ex HBG.

Pathogenicity: To confirm Koch's postulates, 25 ml of a conidial suspension (73000/ml) was used to spray-inoculate two plants till run-off. Control plants were sprayed with sterile water. Plants were maintained in a moist chamber at room temperature (25 ± 2 °C). Plants were uncovered after three days and moved to a greenhouse. The greenhouse temperature fluctuated between 10°C (night) and 34°C (day). Symptoms appeared after 30 days and the fungus was recovered from the spots and margins of symptomatic leaf tissue.

Chupp (1954) studied material from *Saururus* collected in the U.S.A. and Taiwan, and concluded that they represented one species. Tharp (1917) observed that the conidia of *C. saururi* were catenulate, and therefore proposed the combination *Ramularia saururi* (Ellis & Everh.) Tharp. In his treatment of *Ramularia*, Braun (1998) commented that as the conidiophores were reported to be pigmented by Chupp (1954), this specimen did not belong in *Ramularia*. The conidia occurring in chains, as well as the pigmented structures were confirmed in the present study. Furthermore, the absence of superficial mycelium on the type specimen, and thickened, darkened, refractive hila determine that this species would be best accommodated in *Phaeoramularia*. However, a Canadian specimen sent to us from HBG differed in some aspects to the others examined in this study. Conidia were observed to occur singly, and although conidiophores were primarily fasciculate, some also occurred singly on superficial mycelium. The latter features suggest that this specimen can also be placed in *Mycovellosiella*. Profuse mycelial growth of other fungi is also present on these lesions, and the latter may have been due to high humidity conditions that existed shortly before the specimen was collected. When sporulating on peanut stem agar (1.8% autoclaved water agar, cooled to 50°C, poured over dried, sterile, gamma irradiated pieces of *Arachis hypogaea* L. stem, 4-6 cm long), cultures were observed to form well-developed stromata that give rise to dense fascicles of conidiophores. The distinction between *Mycovellosiella* and *Phaeoramularia* is sometimes difficult. However, based on the integrated conidiogenous cells with terminal loci, and generally unbranched conidiophores, the present species would be better placed in *Phaeoramularia*. The type specimen of *C. saururi* and the recent collections from Florida on *Saururus cernuus* represent the same fungus, for which the name *Phaeoramularia saururi* is proposed. This species is distinct, however, from *Pseudocercospora saururicola* Goh & W.H. Hsieh, which is discussed below.

Pseudocercospora saururicola Goh & W.H. Hsieh, *Cercospora* and similar fungi from Taiwan, Hsieh & Goh (1990, p. 301). Fig. 4

≡ *Cercospora saururicola* Sawada, Taiwan Agric. Res. Inst. Rept. 87: 88. 1944. (*nom. inval.*).

Leaf spots subcircular to angular, 3-9 mm diam., brown with gray centres and dark brown margins. *Mycelium* internal, composed of smooth, branched, light brown hyphae, 2.5-3 µm diam. *Caespituli* fasciculate, amphigenous, brown on leaves, with a weakly developed stroma. *Conidiophores* fasciculate, light brown, smooth, unbranched, straight to curved, subcylindrical, 1-3-septate, 20-40 x 2.5-3.5 µm. *Conidiogenous cells* terminal, unbranched, light brown to olivaceous, smooth, tapering to truncate apices, proliferating sympodially, 5-15 x 2.5-3 µm. *Conidia* solitary, olivaceous, smooth, subcylindrical, tapering from truncate bases to subobtuse apices, straight to mildly curved, 4-10-septate, 45-100 x 2.5-4 µm; hila unthickened, not darkened.

Specimens examined: Taiwan, Hsinchu, on leaves of *Saururus chinensis* L., K. Sawada, 22 Aug. 1908, holotype in NTU-PPE (not seen), BPI 441031, 441031 (isotypes !).

When Sawada described *C. saururicola*, he deposited two collections at BPI. These specimens have the same collection data as that of the material in Herb. NTU-PPE (Hsieh & Goh, 1990). *C. saururicola* was never validly described, as it lacked a Latin diagnosis. A re-examination of the type in NTU-PPE found that the Sawada specimen would be better accommodated in *Pseudocercospora*, which led Hsieh & Goh (1990) to validate the name as *P. saururicola*. Since they designated the material in NTU-PPE as holotype, the two duplicates at BPI have to be considered as isotypes. An examination of the two isotypes in the present study found some caespituli of the fungus described by Hsieh & Goh (Fig. 4), but also found material of a true *Cercospora* species (Fig. 5). In their description, Hsieh & Goh (1990) noted that the conidiophores of *P. saururicola* were much narrower and shorter (20-40 x 2.5-3.5 µm) than those seen by Sawada (47-87 x 4.5-5.5 µm). The latter dimensions, however, fit that of the *Cercospora* sp. also observed on the isotypes. It is therefore possible that the original, invalidly described species (Sawada, 1944), was in fact based on two different elements, viz. the true species of *Cercospora* as well as a species of *Pseudocercospora*, which was subsequently treated by Hsieh & Goh (1990). Nevertheless, *P. saururicola* is a validly published name, and more material would have to be collected before the *Cercospora* sp. that also occurs on the rather poor isotype specimens can be treated further.

ACKNOWLEDGEMENTS

The authors gratefully acknowledge the assistance of the curator of BPI for providing the specimens that formed the basis of this study. Dr Uwe Braun (Martin-Luther Universität, Halle, Germany) is thanked for reviewing the script, and for providing additional material (HBG) examined in this study.

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HYPOGEOUS FUNGI FROM THE SOUTHEASTERN UNITED STATES. II. THE GENUS ZELLEROMYCES

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ABSTRACT

Two species of hypogeous basidiomycetes in the genus *Zelleromyces* which had been previously recognized as provisional taxa from the southeastern United States, *Z. sculptisporus* and *Z. versicaulis*, are formally described as new. Additional discussion is provided for *Z. cinnabarinus*, and *Z. ravenelii*, another species described from the southeastern United States, is synonomized with *Z. cinnabarinus*.

KEYWORDS

Zelleromyces, ectomycorrhiza, taxonomy, gastroid, Russulales

INTRODUCTION

The genus *Zelleromyces* was erected in 1960 by Singer and Smith to include fungi which have gastroid basidiocarps that exude latex and basidiospores with amyloid ornamentation, but which usually lack a well-developed stipe-columella. The seven species which were originally placed in this genus were primarily described from the southeast and pacific northwest regions of the United States. A number of other species have since been described from a variety of forest habitats throughout the world (Beaton, Pegler and Young 1984; Miller and Miller 1986; Bougher and Syme 1998; Moreno-Arroyo *et al.* 1998).

During the process of field collecting to obtain fresh sporocarps for use in examining the ultrastructure of basidiospore development in gastroid and agaricoid Russulales (Miller 1988a,b; Miller and Miller 1988), two unidentifiable species of *Zelleromyces* were encountered, to which were attached the provisional names *Z. sculptisporus* and *Z. versicaulis*. The present paper formally describes these as new species. Subsequent examination of many herbarium collections of *Zelleromyces*, including holotypes of all species described to date, also led to the conclusion that two other species should be synonomized.

METHODS AND MATERIALS

Methods of collection, terminology used, and classification were generally those of Singer and Smith (1960). Basidiopore size and shape were from optical sections in side view with the apiculus clearly evident and excluding the ornamentation. Color names and decriptions were taken from the Methuen Handbook of Colour (Kornerup and Wanscher (1981). Herbarium names are abbreviated according to Holmgren, Holmgren and Barnett (1990). Fresh and dried specimens were examined with standard microchemical reagents useful in the genus (Singer and Smith 1960). Mycorrhizal syntheses were conducted using the techniques of Miller *et al.* (1989).

DESCRIPTIONS OF TAXA

Zelleromyces cinnabarinus Singer & A.H.Sm., Mem. Torrey Bot. Club 21: 19, 1960.

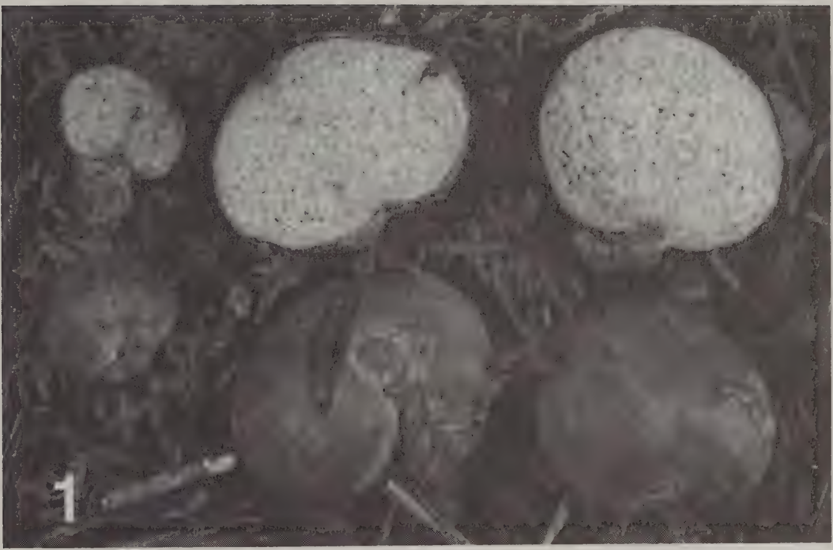
Zelleromyces ravenelii (Berk. & M.A.Curtis) Singer & A.H.Sm., *Mem. Torrey Bot. Club 21: 20, 1960.*

Figures 1, 4, 6-7.

ETYMOLOGY: Latin (*cinnabaris*, a rich brownish-red pigment from the gum of the dragon's blood tree), referring to the color of the peridium.

BASIDIOCARPS: 1-3 cm diam, subglobose, slightly flattened, or turbinate, often lobed from fusion of several basidiocarps, or furrowed to the base. **PERIDIUM:** surface dry, tomentose when young, in age smooth, unpolished above, cottony below and in recesses between lobes; basal attachment prominent, knoblike, composed of a tough, fleshy knot of mycelium or tissue; whitish to orange white (6A-2), or pale orange (6A-3, 7C-6) at first, then brownish orange (7C-6), light brown (7D-6), brown (7D-7,8), or reddish brown (8D-6), often mottled dark reddish brown (7E-7) above. **GLEBA:** loculate, locules irregular in size and shape, smaller toward the base, when young locules widely scattered appearing imbedded in sterile tissue; firm, tramal plates loosely organized, easily separable from each other; columella present, in youth thin, irregular, dendritic, arising from a small sterile base or basal knot, in age noticable as thick tramal tissue radiating from the base; orange white (5A-2, 6A-2) at first, then pale orange (6A-3), in age brown (6D-7), columella and sterile base brownish orange (7C-6) to light brown (7D-6); latex present, abundant in columella, sterile base, and under the peridium, thick white at first, thin, watery, colorless with exposure. **ODOR:** aromatic or pungent when fresh, as in many *Lactarius* spp., in age of rubber. **TASTE:** mild, starchy, mealy.

SPORES: 13-17.5 x 11.5-15.5 µm (excl. orn.), Q= 1.13, globose to broadly elliptical, mostly symmetric, thick-walled, ornamentation a complete reticulum of compressed spines and low, knotted ridges up to 2-3 µm high, with scattered and isolated verrucae, hyaline to pale yellow in KOH, ornamentation darkly amyloid in Melzer's reagent, hilar appendix 1.5-2.5 x 2.0-2.5 µm, cylindrical to slightly conical or attached to a straight, thin-walled segment of sterigmal appendage, often with a broad circular terminal hilar scar. **HYMENIAL ELEMENTS**: basidia 40-50 x 10-13 µm, clavate, bearing 1 or 2 spores, sterigmata 5-10 µm long, cylindrical, usually straight,



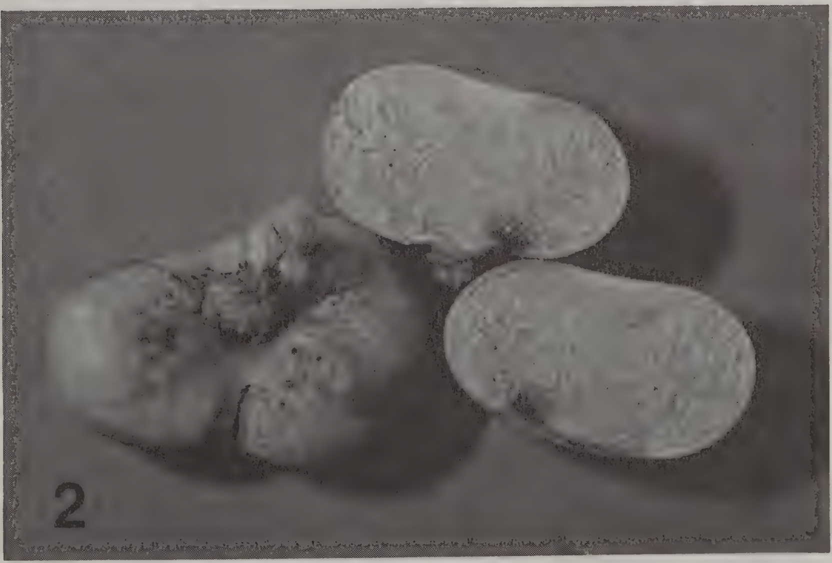


Fig. 1. *Zelleromyces cinnabarinus* (VTMH 4899), x 2. 2. *Zelleromyces versicaulis* (OKM 20875), x 2.5.

often constricted near the hilar appendix; cystidia none. **HYMENOPHORAL TRAMA:** regular or nearly so, of interwoven, sub-parallel hyphae 3-7 µm diam with large inflated, isodiametric, thin-walled cells 15-20 µm scattered throughout, laticiferous hyphae present 7-12 µm diam, cylindrical to swollen and contorted, thin-walled, with yellowish refractive contents in KOH. **SUBHYMENIUM:** present but poorly developed, filamentous to subcellular, 1-2 cells thick, cell diam. 3-7 µm. **PERIDIUM**: Epicutis 10-25 µm thick, a turf of widely scattered to gregarius, cylindrical, narrowly clavate or rarely branching, thin-walled hyphal end-cells, arising from swollen or inflated hyphae, 30-40 x 3-7 µm; subcutis 100-150 µm thick, of periclinally arranged, thin-walled hyphae, 4-7 µm, and scattered inflated cells, 15-20 µm, laticiferous hyphae abundant.

HABITAT AND SEASON: Common throughout the late fall and early winter in the southeastern states to Texas, from November to February associated with pines, especially *Pinus virginiana*, *P. taeda*, *P. echinata* and *P. elliotii*. We have confirmed the ectomycorrhizal habit of this fungus by synthesizing mycorrhizae with *P. virginiana* as a host (Fig. 4).

COLLECTIONS EXAMINED: HOLOTYPE: **Louisiana**, East Feleciana Parish, 26 December 1931, A. H. Smith and C. A. Brown (MICH, FH); other collections: St. Tammany Parish, 2 January 1958, A. L. Weldon and D. E. Stone 5703, 4 February 1956, A. L. Weldon 5704 (both NO). **Alabama**: Lee Co.: Auburn, 9 December 1900, F. S. Earle (NY), 15 December 1900, F. S. Earle (NY). A. H. Povah, 11 December 1921 (MICH) and Lloyd 19848 (BPI), Thaxter 4715 (FH), November 1921, Thaxter 4577 (FH), December 1921 (MICH), 13 January 1922, A. H. Povah 9080 (FH); Spring Hill Co.: A. H. Povah 7128, 7182 (both FH); Bainbridge (Georgia?): December 1892, 1898, A. Foerste (FH). **Arkansas**: Montgomery Co.: 3 December 1982, Edith Nelson, J. Trappe 7174 (OSC); Hempstead Co.: Hope, 1 December 1983, legit Victor Ford, VTMH 4899 (VPI); Saline Co., J. Trappe 8756 (OSC); Saline Co.: October 1984, Edith Nelson, Trappe 8756 (OSC); Union Co.: 3 December 1978, legit J. Justice, Trappe 7380 (OSC). **Florida**: Alachua Co.: Gainesville: 2 February 1929, W. A. Murrill 10448 (FLAS), 24 January 1931, W. A. Murrill 6650 (FLAS and BPI), 45976, 15784 (both FLAS); Leon Co: Tallahasee, 25 December 1951, L. R. Hesler 20271 (FH). **Georgia**: Grady Co.: Tall Timbers Research Station, 25 January 1975, legit P. Kormanek, VTMH 4896 (VPI), 15 February 1975, legit P. Kormanek, VTMH 4895 (VPI); Decatur Co.: Bainbridge, A. F. Foersta (FH). **Mississippi**: Jackson Co.: 3 December 1983, C. Brenke 10154 (NO), 2 December 1983, C. L. Ovrebo 10293 (NO). **North Carolina**: Chattam Co., 24 October 1942, W. C. Coker 13206 (NCU); Moore Co.: Carthage, Donna Mitchell 99-95, 12 October 1995, (OSC 17451); Gaston Co.: 29 November 1983, legit J. Hancock, S. L. Miller 721 (personal collection); Durham Co.: J. N. Couch, 30 October 1938 11055 (NCU); Orange Co.: Chapel Hill, 1 Jan 1923 J.N. Couch 6009 (NCU), 24 October 1950, J. N. Couch 14702 (NCU), 29 October 1946, C. R. Bell 14086 (NCU), 24 October 1942, W. C. Coker 13206 (NCU), 9 February 1923, J. N. Couch 6061 (FH). **South Carolina**: Aiken Co.: Aiken, 1 January 1884, H. W. Ravenel, Rav. Fungi Americani, No. 16, Ellis North American Fungi 1211 (MICH, FH); Darlington Co.: Darlington, December 1960, B. Williamson 15175 (NCU), Society Hill, Ravenel 1849-50 (FH); Honey Co., 23 November, P. Straker, VTMH 4894 (VPI); Williamsburg Co? Santee Canal, December 1848, Ravenel 883 (FH).

DISCUSSION: *Zelleromyces cinnabarinus* is the most common gastroid member of the Russulales in the southeastern and southern U.S. It is usually found on the surface of dense clayey soil and is always associated with pine. The darkly amyloid ornamentation composed of a fine complete reticulum with abundant verrucae is definitive. Sundberg and Murphy (1976) provide a thorough description of the spores using both light and scanning electron microscopy.

Basidiocarps exude abundant white latex and have a pungent odor similar to many species of *Lactarius*. In older sporocarps the odor is of rubber, and the latex may be scarce to absent. In age, the gleba becomes dry and the tramal plates separate slightly to give an almost crumbly texture.

Singer and Smith (1960) stated that *Z. cinnabarinus* was initially identified as *Arcangeliella ravenelii* (Berk. & M.A.Curtis) Dodge which they included under the circumscription of *Zelleromyces*. Their criteria for separating the two taxa were the darker peridium colors, the ellipsoid basidiospores, and absence of sphaerocysts in the hymenophoral trama of *Z. cinnabarinus* in contrast to the lighter peridium colors, nearly globose basidiospores and presence of sphaerocysts in the hymenophoral trama of *Z. ravenelii*. Sundberg and Trappe (1975), in providing detailed descriptions of a fungus correctly identified as *Z. cinnabarinus* from Illinois, suggested that the color range of the peridium was broader than the "cinnabar red" reported in the initial description by Singer and Smith (1960). This species can be quite pale in early stages of development and even in older basidiocarps which have not been exposed to the air and light, or which have not been excessively handled, darkening the cottony tomentum characteristically abundant especially over the lower surface of many undisturbed basidiocarps. In our observation of the spores, no differences were observed in the size or shape if all spores were compared in the same orientation. Miller (1988a) found that a gradation of spore shapes from symmetrical (more globose) to asymmetrical (more ellipsoid) could be found in almost every collection of members of the Russulales. This seems especially true of many species of *Zelleromyces* though it is admittedly difficult to find a large number of spores in the proper orientation. Examination of the type material for both species and many collections that otherwise were referable to *Z. cinnabarinus* revealed that no, or few true sphaerocysts were present in the hymenophoral trama of either taxon. Rather, as Singer and Smith (1960) pointed out the subhymenium of both taxa appeared "cellular in section (but actually of compactly interwoven filaments with cross walls so numerous as to produce isodiametric cells)." Likewise, examination of the peridium in section shows swollen, sphaerocysts-like cells at the base of many hyphal end cells, but no true sphaerocysts. We therefore feel that synonomizing *Z. ravenelii* with *Z. cinnabarinus* is justifiable.

Zelleromyces versicaulis S. Miller sp. nov.

Figures 2, 8-9.

Basidiomata 15-30 mm diam., subglobosa vel turbinata, ad bases eorum exarata, in stipitibus gongylodibus 2-4 mm longis. Peridium bubulinus vel roseobubulinum, prope basim pallidius, supra brunneo-maculatum. Gleba locularis; columella junentate percurrens, linearis, e basi sterili extensa, maturitate fere evanescens, gleba et peridio *concolor; latex primo albus, viscosus, dein hyalinus, deliquescens. Odor haud distinctus. Basidiosporae 8-9 x 6.5-8 µm, ellipsoideae vel ovoideae, asymmetricae, hyalinae; ornamentum tenui-reticulatum vel fracto-reticulatum, amyloideum.*

Holotypus VTMH 4897 in Herbario (VPI) depositus, a Van Cotter et Warren Pruess lectus sub Quercus virginiana et Quercus falcata, Wildhur Camp, Lumberton, Hardin Co., Texas, 5 November 1983.

ETYMOLOGY: Latin (*versi*, changing, and *caulus*, stem), referring to the well developed, percurrent columella in young specimens that is reduced to a sterile base or becomes absent in age.

BASIDIOCARPS: 1.5-3 cm diam, subglobose, slightly flattened, or turbinate, often furrowed to the base; basal attachment prominent in youth, knoblike, composed of a tough, fleshy knot of tissue with adhering soil, absent or much reduced in age. **PERIDIUM:** surface dry, glabrous when young, in age smooth, polished above, cottony below; pinkish white (7A-2), to orange white (6A-2) young, becoming pale orange (6A-3) to pale red (7A-3), paler below, often mottled brown to dark reddish brown (7D, E-7, 8) above. **GLEBA:** loculate, locules irregular in size and shape, 1-2 per mm, firm, tramal plates loosely organized, easily separable from each other, rarely exposed below; columella present, in youth percurrent, arising from a small sterile base or basal knot reminiscent of a stipe-columella, in age non-percurrent, simple to slightly branched, tapering toward the apex, radiating from the base, orange white (6A-2) at first, then light orange (5A-4) to pale orange (6A-3); latex present, abundant in columella, sterile base, and under the peridium, thick, white at first, then thin, watery, colorless with age or exposure. **ODOR:** mild or not distinctive. **TASTE:** mild, mealy to fungoid.

SPORES: 8-9 x 6.5-8.0 µm (excl. orn.), Q= 1.23, slightly asymmetric, elliptic, thin-walled, ornamentation of narrow, low, rugose ridges forming a continuous or broken reticulum, with isolated verrucae, and scattered low warts within the reticulum, hyaline in KOH, ornamentation amyloid in Melzer's reagent; hilar appendix 1-3 x 0.5-1.0 µm, obconical or attached to a straight, thin-walled segment of sterigmal appendage, often with a broad terminal hilar scar. **HYMENIAL ELEMENTS**: basidia 39-50 x 8-9 µm, clavate, bearing 2 or 4 spores, sterigmata 5-8 µm long, cylindrical, straight or bowed, often constricted near the apex; cystidia none. **HYMENOPHORAL TRAMA:** regular or nearly so, of interwoven, sub-parallel hyphae 3-5 µm diam, laticiferous hyphae abundant 7-10 µm diam, cylindrical to swollen and contorted, thin-walled, with yellowish refractive contents in KOH. **SUBHYMENIUM:** present but poorly developed, filamentous to subcellular, 1-3 cells thick, cells 4-8 µm diam. **PERIDIUM**: Epicutis 10-25 µm thick, of widely scattered to gregarius, upright or mostly repent, cylindrical or clavate, thin-walled hyphal end-cells 10-20 x 3-4 µm; subcutis 100-150 µm thick, of periclinally arranged, thin-walled hyphae 4-6 µm diam, and scattered inflated cells 12-15 µm diam., laticiferous hyphae abundant near the hymenial tissue.

HABITAT AND SEASON: Collected in November, may be locally abundant, reported to be associated with *Quercus virginiana* or *Q. falcata* and possibly pines. Typically erumpant or subepigeous in moist dense clayey soil.

COLLECTIONS EXAMINED: HOLOTYPE: **Texas**: Hardin Co., Lumberton, Wildhur Camp, 5 November 1983, legit Van Cotter and Warren Pruess, VTMH 4897 (VPI); other collections 4 November 1983, legit Hanne Dietz, VTMH 4893; 5 November 1983, legit Susan Hamilton, VTMH 4892 (both VPI). **Arkansas**: Pulaski Co.: Hensley, 22 November 1986, legit Edith Nelson S. L. Miller (personal collection).

DISCUSSION: We intitially placed this fungus in the genus *Arcangeliella* because of the mostly asymmetrical, fairly small spores and the glebal exposure near the attachment of a moderately well developed, stipe-like appendage in one of the youngest basidiocarps collected. Subsequent collections revealed that glebal exposure is a feature of relatively few basidiocarps, and that the presence of the appendage near the base is highly variable, and best described as a tough rhizomorphic attachment rather than a true stipe columella.

Zelleromyces sculptisporus S. Miller sp. nov.

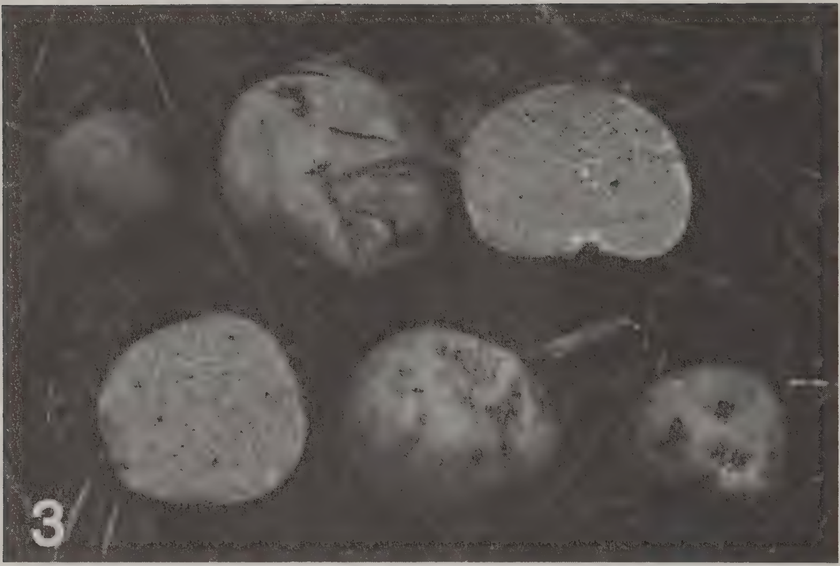
Figures 3, 5, 10-12.

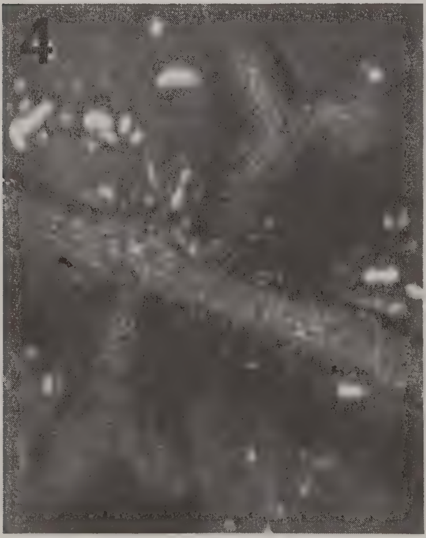
Basidiomata 10-25 mm diam., subglobosa vel complinata, prope basim rhizomorphis extensis. Peridium aureum vel aureo-brunneum. Gleba locularis, alutacea; columella alba vel cinerascens, ramosa, exigua e basi sterili ; latex viscosus, albus, in siccitate griseus. Odor graveolens, Sclerodermate citrino similis. Basidiosporae 13-15.5 x 11.5-14 µm, globosae vel subglobosae, symmetericae, hyalinae vel luteolae; ornamentum reticulatum vel fracto-reticulatume, e verrucis et cristis altis, pseudoamyloideum, particulis amyloideis dispursis praeditum.

Holotypus VTMH 4898 (VPI), legit S. L. Miller, lectus sub Pinus pungens, Cumberland Gap National Historic Park Campground, Lee Co., Virginia, 1 July 1984.

ETYMOLOGY: Latin (*sculptus*, engraved, carved out, and *spora*, spore), referring to the large, exagerated ornamentation on the spores.

BASIDIOCARPS: 1-2.5 cm x 1.0-1.5 cm diam, subglobose, oval, or slightly depressed, often irregular when young, base with fine knot of 2-3 hyphal cords, occasionally holding a small mass of soil. **PERIDIUM:** surface dry, minutely velutinous overall in youth, in age smooth, unpolished above; greyish yellow (4B-4), golden yellow (5B-7) or brownish yellow (5C-7) in the depressions, finally brownish yellow (5C-7) overall, but lighter below and mottled with greyish yellow (4B-4) above; in cross-section 0.5 mm thick, outer layer greyish yellow, inner layer pallid white with veins of sterile tissue. **GLEBA**: Loculate, locules small at first, appearing stuffed with tissue, tramal plates loosely organized, easily separable from each other, white when young, then greyish orange (5B-4,5), in age brownish orange (5B-6); columella present, fine, dendritic, cartilaginous, radiating from small sterile base, and continuous with veins of





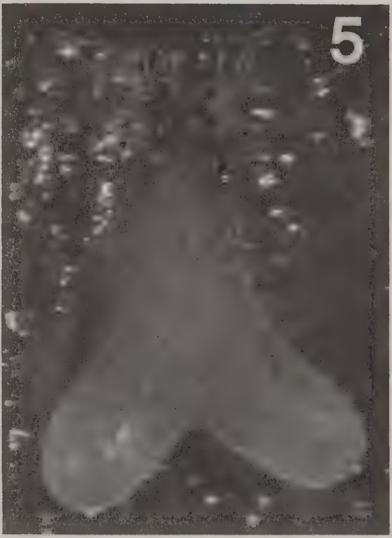


Fig 3. *Zelleromyces sculptisporus* (SLM 764), x 1.5. Figs. 4-5. Ectomycorrhizae formed by species of *Zelleromyces*. 4. *Zelleromyces cinnabarinus* + *Pinus virginiana* ectomycorrhizae, x 10. 5. *Zelleromyces sculptisporus* + *Pinus pungens* ectomycorrhizae, x 10.

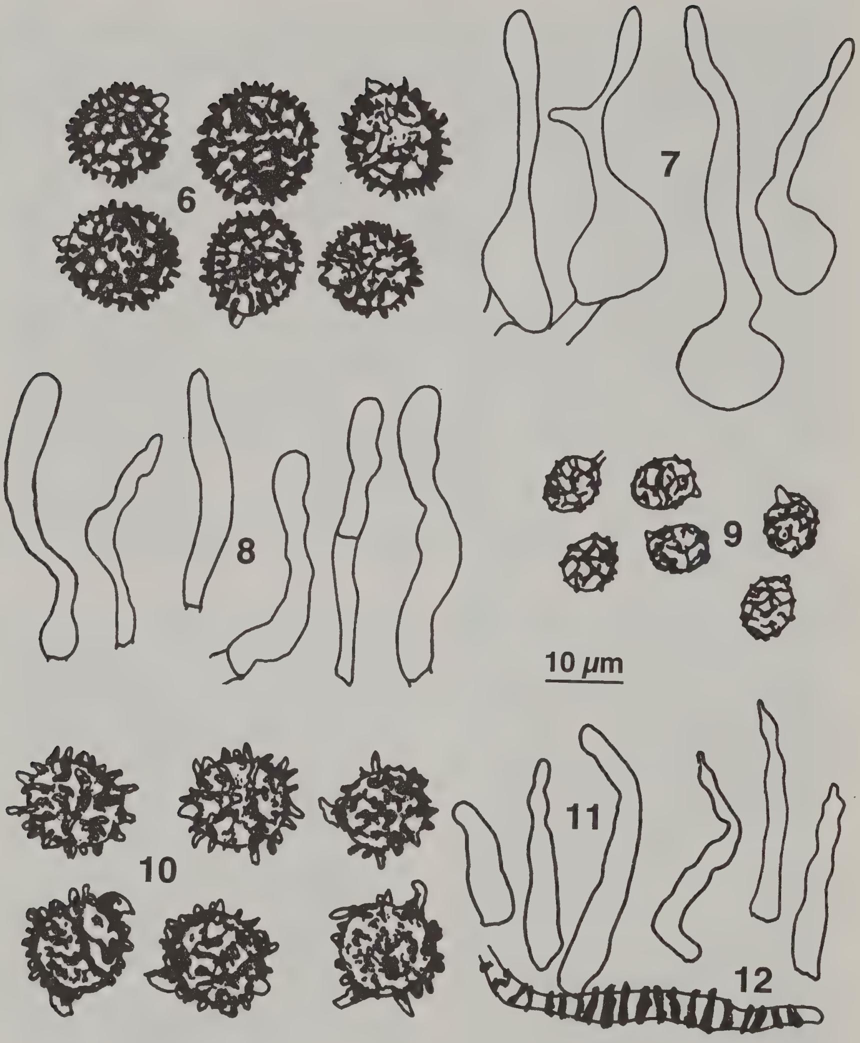
sterile tissue from inner layer of peridium, white to grey; spores in mass light yellow (approx. 4A-4,5); latex abundant from inner layer of peridium, sterile base and columella, thick, white, drying dull grey. **ODOR:** strong, similar to *Scleroderma citrina.* **TASTE:** mild, starchy, mealy.

SPORES: 13-15.5 x 11.5-14 µm (excl. orn.), Q=1.12, globose to broadly elliptic, mostly symmetric, thick-walled; ornamentation a low reticulum when young, of broad, high, often curving or forking ridges 0.2-4.0 µm high, and isolated verrucae forming a continuous or broken reticulum, producing a winged appearance when older, hyaline to yellowish in KOH, ornamentation amyloid in Melzer's reagent only when young, pale yellow to lightly dextrinoid in age with scattered pockets of amyloid material near the base of the ridges; hilar appendix 3-4 x 2-3 µm, cylindrical to obconical, often attached to a segment of sterigmal appendage and with a broad terminal hilar scar. **HYMENIAL ELEMENTS**: basidia 30-45 x 10-15 µm, clavate, bearing 2 or 3 spores, sterigmata 5-8 µm long, cylindrical or tapering upward, straight; cystidia none. **HYMENOPHORAL TRAMA:** regular or nearly so, of somewhat gelatinizing, interwoven, sub-parallel hyphae, 4-7 µm diam, laticiferous hyphae abundant, 5-8 µm, cylindrical to swollen and contorted, thin-walled, with yellowish refractive contents in KOH. **SUBHYMENIUM:** present but poorly developed, filamentous to subcellular, 1-2 cells thick, 3-8 µm diam. **PERIDIUM**: epicutis 10-25 µm thick, a turf of widely scattered to gregarius, aculeate and often strangulate, thin-walled dermatocystidia, 25-50 x 4-8 µm; subcutis 100-150 µm thick, of highly gelatinizing, cylindrical to inflated, periclinally arranged, thin-walled hyphae 2-7 µm diam, abundant primordial hyphae 4-8 µm diam, with waxy, spiral encrustations, and scattered sphaerocysts 15-25 µm diam, laticiferous hyphae abundant throughout.

HABITAT AND SEASON: Summer, may be locally abundant associated with *Pinus pungens*, and possibly *Picea abies* and *Pinus strobus*. Hypogeous in loose, sandy soil. We have confirmed the ectomycorrhizal habit of this fungus by synthesizing mycorrhizae with *P. pungens* as a host (Fig. 5).

COLLECTIONS EXAMINED: HOLOTYPE: **Virginia**: Lee Co., Cumberland Gap National Historic Park Campground, 16 July 1984, legit S. L. Miller, VTMH 4898 (VPI); 16 July 1998, legit S. L. Miller, SLM 9500 (personal collection). **West Virginia**: Pocahontas Co.: Droop Mountain State Park, 8 July 1993, legit Donna Mitchell 56-95 (OSC 13217).

DISCUSSION: This fungus was tentatively identified in the field as *Z. ravenelii* (Berk. & Curtis) Singer & A.H.Sm., which was the "other" lighter colored species of *Zelleromyces* expected to occur in the southeastern U.S. (see earlier comments under *Z. cinnabarinus*). However, the mottled brownish yellowish color when fresh and the dramatic winged spore ornamentation up to 4 µm high, which is more brownish than dark blue in Melzer's reagent, is distinctive. Miller (1988a) examined spores of *Z. sculptisporus* using TEM and light microscopy and found that the ridges are composed of irregular pockets of amyloid, dextrinoid and hyaline wall material. Care should be taken when examining only dried material as this fungus dries a dark bay or cinnabar red. However, the spores of *Z. sculptisporus* and *Z. cinnabarinus* can be differentiated



Figs. 6-12. Spore and peridium morphology of species of *Zelleromyces* from the southeastern United States. 6-7. Basidiospores and hyphal end cells of *Z. cinnabarinus*. 8-9. Hyphal end cells and basidiospores of *Z. versicaulis*. 10-11. Basidiospores and hyphal end cells of *Z. sculptisporus*. 12. Encrusted primordial hyphae in the peridium of *Z. sculptisporus*.

easily even in dried material and this fungus appears to fruit in the summer rather than late fall and winter as for *Z. cinnabarinus*. Interestingly, *Z. sculptisporus* was found in the same locale at Cumberland Gap National Historic Park Campground on the same date fourteen years apart. This confirms a strong mycorrhizal relationship with *P. pungens* and perhaps other conifers.

ACKNOWLEDGEMENTS

Portions of this study were supported by grants from the National Science Foundation (IBN9318568), the Denver Botanic Garden and a Faculty Grant-in-Aid to the first author. Dr. Harry Thiers provided insight on the possible generic placement of *Z. versicaulis*. The loan of specimens is acknowledged from the following herbaria, their curators, and staff: University of Michigan (MICH), Farlow Herbarium (FH), New York Botanic Garden (NY), University of Florida (FLAS), Tulane University (NO), Virginia Tech (VPI) University of North Carolina (NCU), National Fungus Collections (BPI), and Oregon State University (OSC). Patricia Eckel, Clinton Herbarium, kindly provided valuable corrections for the latin diagnoses.

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MYCOTAXON

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DACTYLARIA ASYMMETRICA, A NEW SPECIES OF MITOSPORIC FUNGI FROM IVORY COAST FOREST LITTER

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Dactylaria asymmetrica sp. nov. encountered on decaying leaves of *Manilkara obovata* (Sabine & G. Don) J.H. Hemsley in the tropical rain forest litter in the Ivory Coast, is described, illustrated and compared with related taxa.

Keywords: *Dactylaria asymmetrica*, new species, mitosporic fungi.

During mycological investigations carried out on tropical forest litter in Tai National Park, Ivory Coast, a new species of the genus *Dactylaria* Sacc. (type species *D. purpurella* (Sacc.) Sacc.) was discovered. Because of the difficulties in culturing the fungus on artificial media, the morphological description of the fungus is based on characters observed on the natural substratum.

Dactylaria asymmetrica Pasqualetti sp. nov. (Figs 1-5)

Etym.: in reference to the asymmetrical position of the conidial septum.

Coloniae effusae, pallide brunneae. Mycelium immersum. Conidiophora macronematosa, mononematosa, solitaria vel interdum aggregata, simplicia, erecta, recta vel leviter flexuosa, septata, levia, ad basim brunnea vel pallide brunnea et crassitunicata, superne pallidiora et tenuitunicata, usque ad 65 μm longa, 3-4 μm crassa. Cellulae conidiogenae polyblasticae, in conidiophoris incorporatae, terminales, sympodiales, denticulatae (denticulis conicis), ad apicem rotundatae, interdum geniculatae, pallide flavescentes, tenuitunicatae, leaves, 6.5-30 μm longae, 2.5-4 μm prope basim latae. Conidia holoblastica, echinulata, tènuitunicata, subhyalina, uniseptata, clavata, sursum rotundata ad basim restricta, 15-20 x 3-4.5 μm, cellula basali maiore (9.5-13 μm) quam apicali (4-6.5 μm). Teleomorphosis ignota.

Holotypus: in foliis emortuis *Manilkarae obovatae* (Sabine & G. Don) J.H. Hemsley, 25 March 1992; Tai, in Ora Eboris, A. Rambelli, IMI 363099.

Colonies effuse, pale brown. Mycelium immersed in the substratum. Conidiophores macronematous, mononematous, arising singly or in groups, simple, erect, straight or somewhat flexuous, septate, smooth, brown or pale brown, thick-walled at the base, progressively paler and thin-walled above, up to 65 μm long and 3-4 μm wide near the base. Conidiogenous cells with polyblastic proliferation, integrated, terminal, sympodial, denticulate, sometimes geniculate, pale, thin walled, smooth, 6.5-30 μm long, 2.5-4 μm wide near the base. Conidial ontogeny holoblastic, conidia arising in sympodial order on denticles of the conidiogenous cells; conidia thin-walled, echinulate, subhyaline, clavate, with rounded upper end and narrowed base, 1-septate, with septum in the upper part of the conidium, 15-20 x 3-4.5 μm, basal cell 9.5-13 μm long, apical cell 4-6.5 μm long. Conidial secession schizolytic. Chlamydospores absent. Teleomorph unknown.

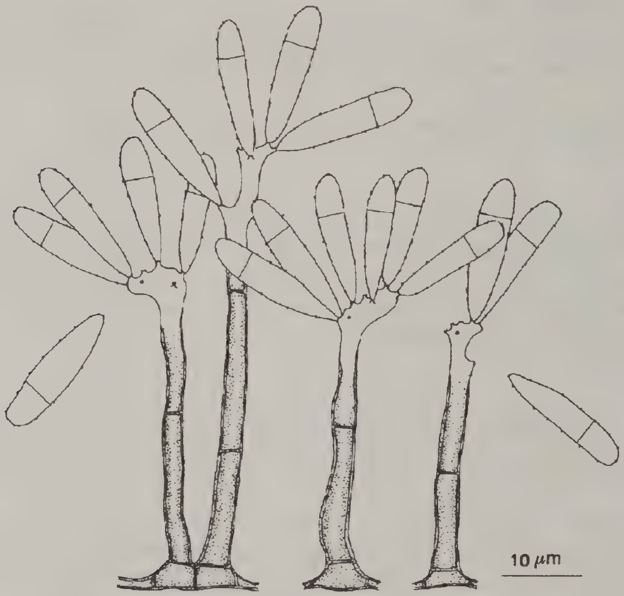
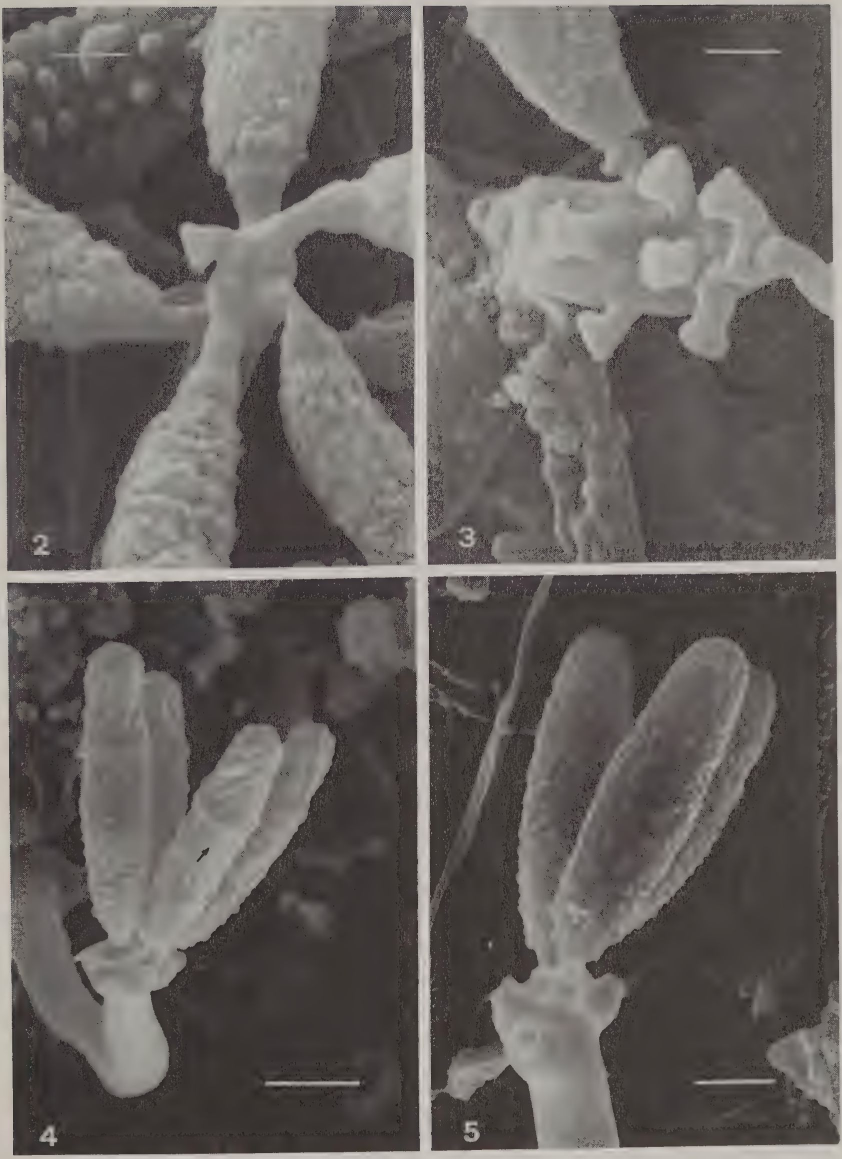


Fig. 1. *Dactylaria asymmetrica.* Conidiophores and conidia.

The genus *Dactylaria* was established by Saccardo (1880) with the type species *D. purpurella* (Sacc.) Sacc. In the original diagnosis, the genus was characterized by "conidia ... 2-pluriseptata "; in 1968 Bhatt and Kendrick amended the diagnosis of *Dactylaria* to include species with 1-septate conidia and exclude those with more than 4 septa. This reduction of accepted species just on the basis of the number of septa, was



Figs 2-5. *Dactylaria asymmetrica*. Scanning electron micrographs. Figs 2, 3. Polyblastic conidiogenous cells with denticles, bar = 2 µm. Fig. 4. Conidia with septum seen as a prominent ring on the wall (arrow), bar = 5 µm. Fig. 5. Sympodial proliferation of the conidiogenous cell, bar = 3 µm.

not accepted by several authors (Onofri and Zucconi, 1984; De Hoog, 1985; De Hoog and Van Oorschot, 1985). De Hoog (1985) redefined the genus *Dactylaria* by "...Conidiophores cylindrical or somewhat tapering, erect, thick-walled or undifferentiated, (sub)hyaline or brown, continuous or septate, with cylindrical or tapering denticles in the apical region. Conidia hyaline or pale brown, thin-walled, septate" and subdivided it into four sections: *Dactylaria, Mirandina, Diplorhinotrichum* and *Pleurophragmium.* A further revision of 41 species (after De Hoog 1985) was published by Goh and Hyde (1997).

The species described here presents characters of section *Mirandina* including, such as conidiophores which are brownish mainly toward the base and erect, cylindrical and tapering towards the apex, and narrow, clavate conidia.

The conidial production was investigated with the scanning electron microscope (Figs 2-5). The walls of the conidiophore and conidiogenous cells are smooth, but the conidia are rough-walled (Figs 2, 4, 5); the conidia are holoblastically produced on denticles at the apex of conidiogenous cells, and delimited by a basal septum. The denticles are smooth and cylindrical (Figs 2, 3). The conidia are clavate with rounded terminal end and a narrow base, with a septum in the upper part, visible by SEM as a prominent ring on the wall (Fig. 4, arrow). The conidial secession is schizolytic. The conidiogenous cells (Figs 2, 3, 5) show polyblastic proliferation.

D. asymmetrica is the only species, of section *Mirandina*, with echinulate conidia. Other species of section *Pleurophragmium*, *D. dioscorae* M.B. Ellis, *D. kumamotoënsis* Mats. and *D. parvispora* (Preuss) de Hoog & v. Arx, present echinulate conidia, but they differ from *D. asymmetrica* in characters of the conidia and conidiophores.

The morphological characters of *D. asymmetrica* were compared with *D. obtriangularia* Mats. (sect. *Mirandina.*) with one septum in the upper part but with narrower conidia (24-37 x 2.2-3 µm at the rounded tip; Matsushima, 1975) and with *D. isoscelispora* W.B. Kendr. & R.F. Castañeda (section not indicated by the authors) also with 1-septate conidia (Castañeda Ruíz and Kendrick, 1990). Conidia of this species are similar in dimensions but are wedge-shaped.

Other species with asymmetrical position of the septum, but in the lower part of the conidium are: *D. endophytica* W. Wu, B. Sutton & Gange (Wu *et al.*, 1996) and *D. mitrata* Mats. (Matsushima, 1983).

The asymmetrical position of the septum in the upper part and the echinulate conidia distinguishes our species from all the species of *Dactylaria* hitherto described.

Hence it is proposed that *D. asymmetrica* is placed as a new species in the section *Mirandina* sensu De Hoog (1985).

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We are grateful to Prof. L. Ake Assi for taxonomic determination of the substratum and to Drs G.S. de Hoog and W. Gams for a critical review of the paper.

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SEIMATOANTLERIUM NEPALENSE,AN ENDOPHYTIC TAXOL PRODUCING COELOMYCETE FROM HIMALAYAN YEW (TAXUS WALLACHIANA)

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ABSTRACT

Seimatoantlerium nepalense, sp. nov. is described as a coelomycetous species. It was isolated as an endophyte of *Taxus wallachiana* in the Kaski district of Western Nepal. The genus is characterized by the dehiscent apical appendage apparatus on its conidia, its unique method of acervular conidiogenesis, and its basal conidial appendage arising exogenously to a pedicel. This species primarily differs from the only other known fungus in this genus, *S. tepuiense*, by virtue of its smaller conidial size, structural differences in the apical conidial appendage apparatus, a unique pigment deposition in the sub-apical cells, its endophytic nature, and its plant host. Most notably, however, both species in this genus produce taxol in culture.

Keywords: appendage apparatus, cancer, endophyte, scanning electron microscopy.

INTRODUCTION

Since the discovery that the endophytic fungus, *Taxomyces andreanae*, produces extremely small amounts of taxol (ca. 50 ng per l) the anticancer drug-taxol, an extensive search for other taxol producing fungi has been launched. Many endophytic fungi including *Periconia, Monochaetia* and *Alternaria* have been shown to be taxol producers. However, an isolate of *Pestalotiopsis microspora*, an endophytic fungus of many rainforest plants, produces up to 500–1000 times more taxol than *T. andreanae* (Stierle et al., 1993). Recently, another new fungal taxon—*Seimatoantlerium tepuiense* has been described that also produces taxol (Strobel et al., 1999). It was found as an epiphyte of the Venezuelan-Guyanan plant—*Maguireothamus speciosus*

Maguire. The goal of the present report is to describe a species of a coelomycetous endophyte of *Taxus wallachiana* Zucc. as a taxol producer.

MATERIALS AND METHODS

Twig samples (1.0 x 20.0 cm) were taken from the lower portions of yews located in the Himalayan foothills at 2300–3800 m in Nepal. The samples were acquired from 11 locations in 9 different representative districts from the entire East to the West of Nepal. The twig samples were stored at 4° C until they were transported to Montana State University by air. The twigs were first thoroughly treated with 70% ethanol and the outer bark removed with a scapel. Small pieces of whitish inner bark (phloem/cambium) were aseptically removed and placed on water agar. Hyphal tips of developing fungi, 4-8 days after incubation at 22° C, were placed on potato dextrose agar (PDA). Pure cultures were obtained in this manner. After 7-10 days of incubation on PDA plates, fungal colonies not producing any fruiting structures were transferred to gamma irradiated carnation leaves (0.5 x 0.5 cm) to encourage spore production. This was done since autoclaved yew wood and bark used as a medium for the fungus yielded only deformed fruiting structures and conidia.

Carnation leaves supporting mycelial growth and acervulus production were fixed and dehydrated for scanning electron microscopy (SEM) (Upadhyay et al., 1991). For SEM, the plant material was critical point dried, gold sputter coated, and observed with a JEOL 840 A scanning electron microscope. Fungal spores required a 1 hour exposure to water in order to prevent "puckering" of the cell walls. Micrographs of the spores after SEM served as a means to make critical measurements of fruiting structures and spores. Laser scanning light micrographs were taken with a Zeiss confocal microscope equipped with an argon laser with 488 and 514 nm wavelengths.

The fungus of interest (TWKN-15X) was grown in 10-2l Erlenmeyer flasks containing 500 ml of MID medium supplemented with 1 g soytone per liter (Strobel et al., 1996). The fungus cultures were incubated for 3 weeks at 22° C under still conditions. Ultimately, after passing the culture fluid through four layers of cheesecloth to remove the mycelium, the filtrate was diluted up to 20%, by volume, with acetonitrile. This mixture was passed through a Waters Sep–Pak C-18 cartridge (10g) and the taxol eluted from the column by rinsing with 120 ml of 60% acetonitrile in water. All other chromatographic methods to acquire taxol employed standard chromatographic procedures as previously described (Strobel et al., 1999). Taxol was detected on thin layer chromatographic plates (EM-0.25mm silica gel) using a spray reagent consisting of 1% vanillin in sulfuric acid after gentle heating (Cardellina, 1991).

After isolation from TWKN-15X, the putative taxol was dissolved in 100% methanol and the UV spectrum obtained in a Beckman DU-50 spectrophotometer. Electrospray mass spectroscopy was done on samples dissolved in methanol: water: acetic acid 50:50:1 v/v/v according to previously described techniques and instrumentation (Strobel et al., 1996). Taxol was initially determined in the methylene dichloride extract of each of the cultures of the endophytic fungi obtained from the Himalayan yew trees via a monoclonal antibody technique. The taxol assays were carried out by a competitive inhibition immunoassay method (CIEIA) using a taxol immunoassay kit (Hawaiian Biotechnology Group, Aiea, Hawaii) (Grothaus et al.,1993). Detection was by an alkaline phosphatase reaction with standardization by a curve contructed with a taxol standard supplied with the immunoassay kit. The sensitivity of the assay is + or – 1.0 ng per ml and is extremely taxol specific.

RESULTS AND DISCUSSION

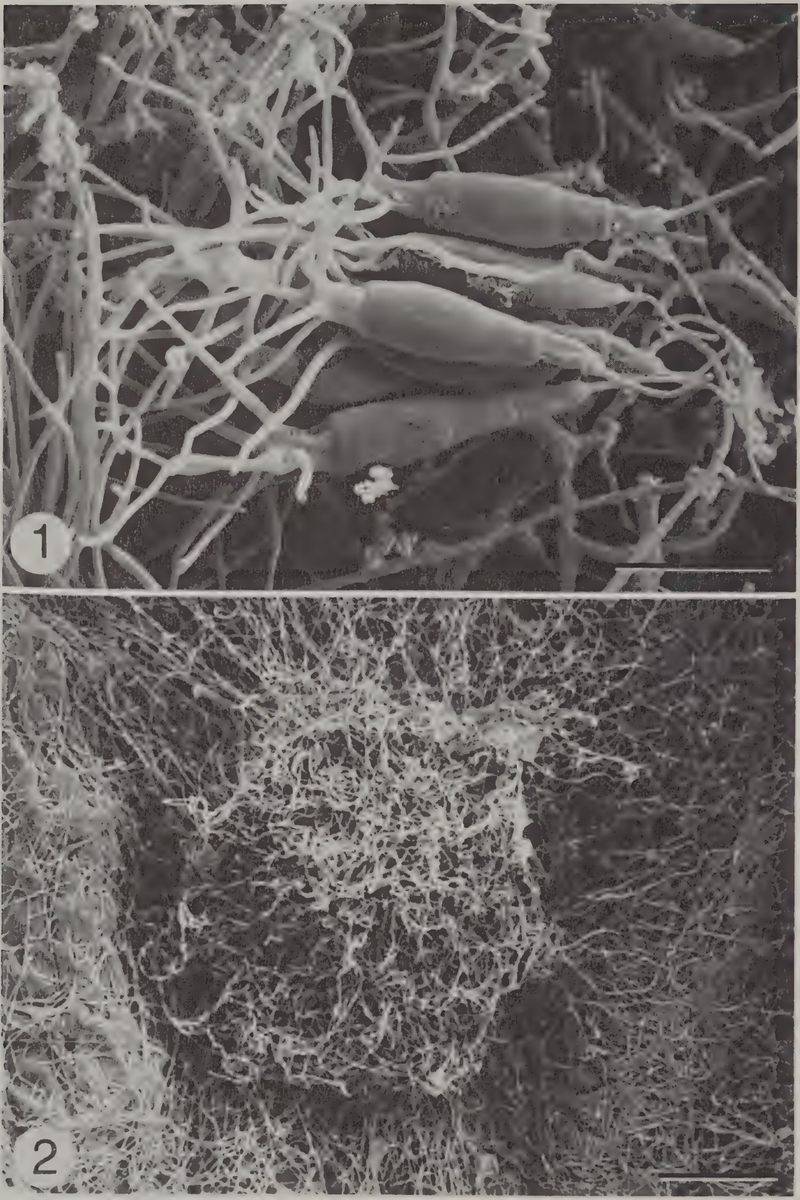
Yew Endophytes

At least 282 fungal endophytes were obtained from the *T. wallachiana* twig samples collected in the Himalayan foothills. The most representative fungal genera isolated were *Xylaria, Phoma, Fusarium, Trichoderma, and Pestalotiopsis.* About 5% of these endophytes produced more than trace amounts of taxol (> 50 ng per liter), as measured by the CIEIA antibody method. However, one putative taxol producing endophyte was of special taxonomic interest. This fungus was designated TWKN-15X and had been obtained from the Kaski district in the mid–western area of Nepal. This fungus was selected for further study to both confirm the chemical identity of taxol in its culture medium as well as its taxonomic identity.

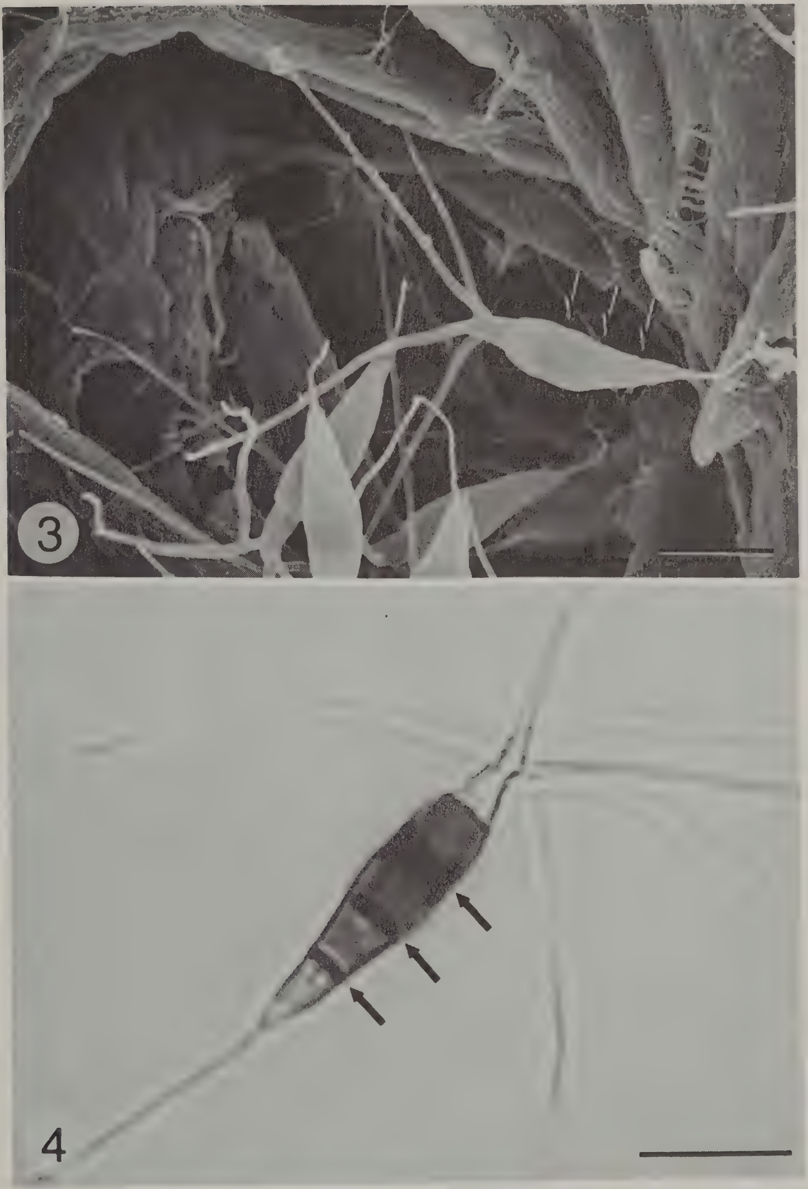
Fungal Taxonomy

Seimatoantlerium nepalense Bashyal, Li, Strobel, Hess, and Sidhu sp. nov. (Figs 1-8).

Fungus acervulis 250-400 µm diametro (Fig. 2). *Cellulae conidiogenae* tegentes parietem acervuli holoblastiae sunt unaquaeque apice conidium singulum ferunt (Fig. 1). *Conidia* 4-6 µm diametro et 13-20 µm longitudine, transverse septata; cellulae terminalis hyalinae; cellulae internae brunneolae tres (Figs. 1, 3-8). *Cellula apicalis* appendicibus plerumque 5 (interdum 4-6) aliquando ramosis (apparatus appendiceus); appendice vulgo circa 25 µm (minus quam 10 µm usque 40 µm) longitudine (Fig. 3, 4); dehiscentia apparatus appendicei posse profert in spora sine vestigio appendicibus apicalibus (Fig. 6). *Cellula subapicalis* plerumque pigmento brunneolo denso in area parietis contigui medicellulae sporae cingenti (Fig. 3). *Cellula basalis* proprie pedicello 2-15 µm longitudine, vestigium cellulae conidiogenae est necnon aliquando appendice parva portata exogene conidiophoro (Figs. 5, 7). Differt hic fungum *S. tepuiensi* Strobel et al. (quod speciem alteram illius genus modo est) conidiis parvioribus, appendicibus apicalibus paucioribus longioribus, pigmento insuete locato cellula subapicali, et est endophytum in *Taxo wallichiana* Zucc.



Figs. 1-2. Scanning electron micrographs of *S. nepalense*. 1. Conidia. Bar=10 µm. 2. Acervulus. Bar=100 µm.



Figs. 3-4. *S. nepalense*. 3. Scanning electron micrograph showing a typical conidium. Note that regions of septa are difficult to visualize (arrows). Bar=10 µm. 4. Laser scanning light micrograph of a conidium showing septa (arrows). Note the brownigh pigmentation surrounding the wall area adjacent to the middle spore. Bar=10 µm.

Fungus with acervuli 250-400 μm in diameter (Fig. 2). Conidiogenous cells covering the acervular wall are holoblastic and each one bears a single conidium from the apex (Fig. 1). Conidia 4-6 μm in diameter and 13-20 μm in length, transversely septate; the terminal cells hyaline; the three internal cells brownish (Fig. 1, 3-8). Apical cell with mostly 5 (sometimes 4-6) occasionally branched appendages (the appendage apparatus); appendages generally about 25 μm (less than 10 μm up to 40 μm) in length (Fig. 3, 4); dehiscence of the appendage apparatus can result in a spore without a trace of the apical appendages (Fig. 6). Subapical cell usually with dense brownish pigmentation surrounding the wall area adjacent to the middle cell of the spore (Fig. 3). Basal cell characteristically with a pedicel 2-15 μm in length, it being a remnant of the conidiogenous cell, and also occasionally with a small appendage borne exogenously to the coniodiophore (Figs. 5, 7).

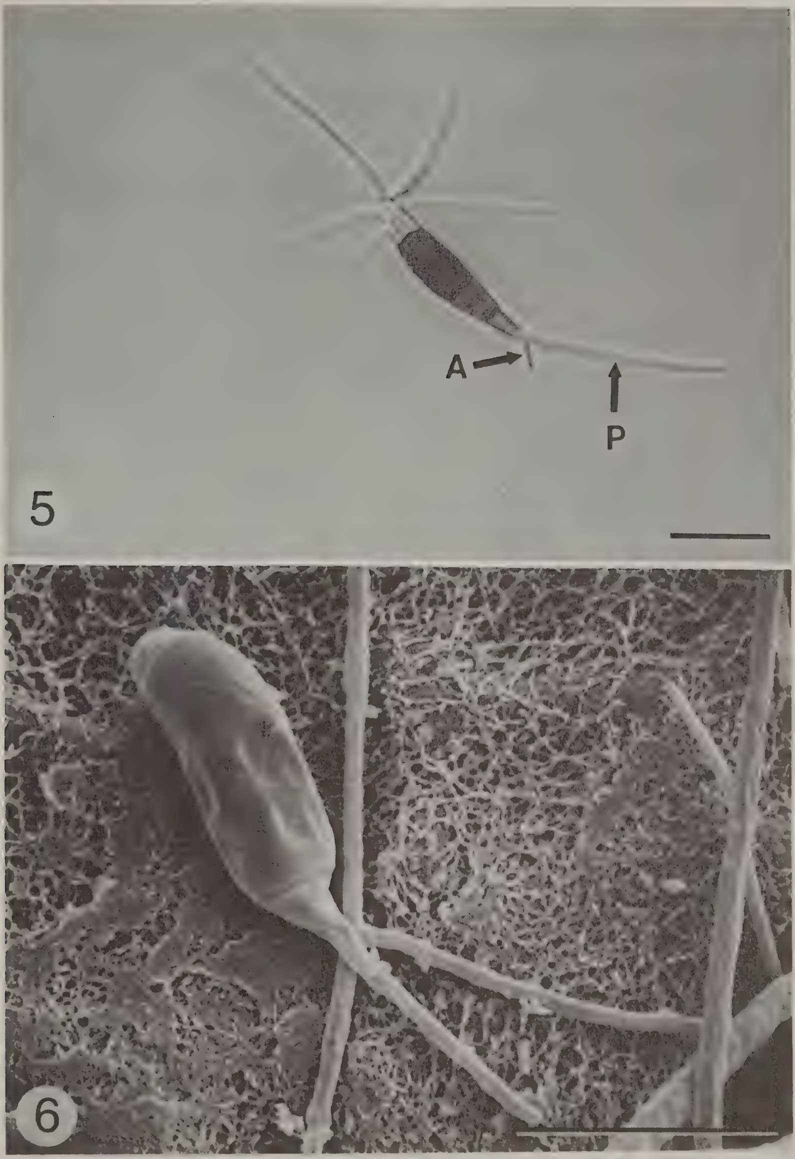
This fungus differs from *S. tepuiense* Strobel et al. (which is the only other known species of this genus) by the smaller conidia, longer and fewer apical appendages, unusually located pigment in the subapical cell, and it being an endophyte on the Himalayan yew (*Taxus wallichiana* Zucc.). The appendage apparatus can dehisce resulting in a spore with no traces of apical appendages (Fig. 6). All morphological comparisons made between these two species were done on fungi grown on gamma irradiated carnation leaves since autoclaved yew wood and bark yielded spores that were distorted and not usable for morphological studies.

Holotypus: Endophytic on *T. wallachiana*. Arrangements for collecting were made by Dr. B. Bashyal of the Royal Nepal Academy of Sciences, Kathmandu, Nepal. The fungus is deposited in the Montana State University Herbarium (MONT) as Bashyal TWKN-15X. A living culture has been placed in the Montana State University Mycologicla Collection of Dr. Don Mathre No. 2047.

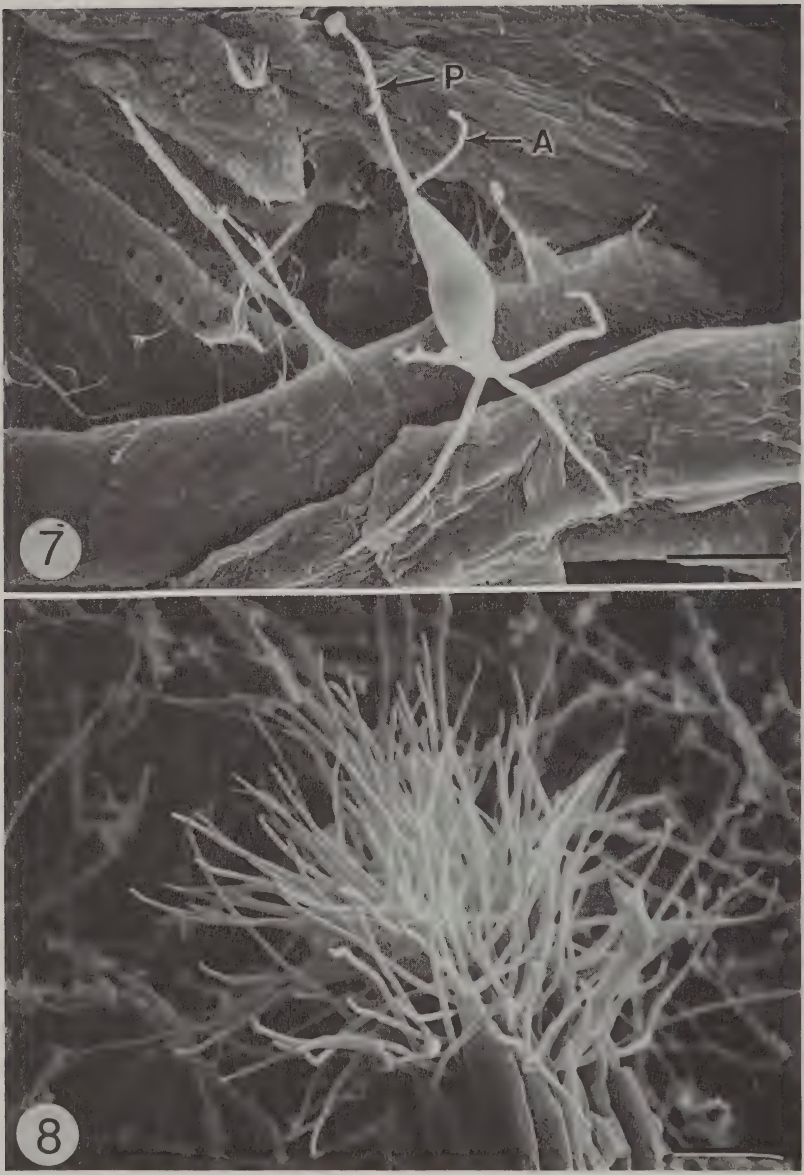
Telomorph: Unknown

Comparative Taxonomy

The mode of conidiogenesis in *Seimatoantlerium* spp. differs significantly from other fungi having appendage bearing conidia such as *Pestalotiopsis*, *Seimatosporium*, and *Seimatosporiopsis* (Sutton, 1980; Raj, 1993). In contrast to these fungi; *Seimatoantlerium* spp. have a pedicel which is a remnant of a conidiogenesis cell (Figs. 5,7). Thus, the pedicel ranges widely in length depending upon where cleavage of the conidiophore occurs. Likewise, the basal appendage, when present, is generally short and it arises exogeneously to the conidiophore similar to the appendages in *Seimatosporium* spp., but in contrast to the basal appendage in *Pestalotiopsis* spp. which arises internally (within the conidiophore) (Sutton, 1980) (Fig. 7).



Figs. 5-6. *S. nepalense*. 5. Laser scanning light micrographs showing a pedicle (P) and a short appendage (A). Bar=10 μm. 6. Scanning electron micrograph showing absence of the appendage apparatus. Bar=10 μm.



Figs. 7-8. Scanning electron micrographs of *S. nepalense* conidia. 7. Conidium showing a pedicle (P) and long appendage (A). Bar=10 µm. 8. Conidia showing intertwining of terminal appendages. Bar=10 µm.

The appendage apparatus in *S. tepuiense* can dehisce upon handling making it possible to find spores with no apical appendages as well as individual apical appendage apparatii (Strobel et al., 1999). Although this phenomenon occurs in *S. nepalense* , it does so less frequently (Fig. 6). Furthermore, we have never observed the dehiscence phenomenon in *Pestalotiopsis* spp. It has been suggested that the appendage apparatus of this and other appendage bearing fungi may serve to aid in the dispersal of the spores. This may occur via the interaction of the appendages with the pinnae on the feathers of birds (Strobel et al., 1997). Also, as the appendage apparatii of many spores may interact to form clumps, this may facilitate the movement of the spores in free flowing water with the eventual attachment of the appendages to hydrophobic leaf surfaces (Strobel et al., 1997) (Fig. 8).

On the other hand, *S. nepalense* has many features in common with *S. tepuiense* including the method of conidiogenesis, a dehiscent appendage apparatus, the number of cells in the conidium, the occasional occurrence of a small basal appendage apparatus, a fluffy, whitish-brown mycelium on PDA, and the presence of numerous lengthy apical appendages. The differences, however, between the two organisms are striking enough for them to be considered distinct species.

Of the 282 endophytic fungi isolated from Himalayan yew twig samples, *S. nepalense* appeared only once. Likewise, in a broad sampling of rainforest plants and plants indigenous to the two tepuis of the Venezuelan-Guyana, *S. tepeuiense* appeared only once, but in that case as an epiphyte from the Roraima tepui on *M. speciosus* (Strobel et al., 1999). Thus, there may be distinct ecological differences between *S. tepuiense* and *S. nepalense* in both their plant preferences as well as their plant/microbe relationships; *S. tepuiense* being epiphytic and *S.nepalense* being endophytic.

Taxol Production

Most notably, however, *S. nepalense* produces taxol in its culture medium which was determined by the CIEIA method in several experiments to range from 62-80 ng per liter. No taxol was detected in the culture medium alone, or in the culture medium at 0 time containing fungal inoculum (several small pieces of PDA supporting mycelial growth). The presence of taxol was confirmed by comparative UV spectroscopy and thin layer chromatograpy using standard taxol as a reference compound. Also, in electrospray mass spectroscopy the peaks at 854 $(M+H)^+$ and 876 $(M+Na)^+$ are characteristic for taxol (Strobel et al., 1996). Taxol is also produced by *S. tepuiense* but in greater amounts per liter (Strobel et al., 1999).

ACKNOWLEDGEMENTS

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POLYPORE DIVERSITY IN THE STATE OF BAHIA, BRAZIL: A HISTORICAL REVIEW

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ABSTRACT

A critical analysis of polypore diversity was carried out for the State of Bahia, Brazil including a historical review and field survey. A total of 139 taxa have been recorded between 1836 and 1998 belonging to the families *Coriolaceae* (29 genera), *Hymenochaetaceae* (4 genera), *Polyporaceae* (4 genera), *Ganodermataceae* (3 genera), *Meruliaceae* (2 genera), *Grammotheleaceae* (1 genus), *Bondarzewiaceae* (1 genus), *Exidiaceae* (1 genus) and *Tricholomataceae* (1 genus). Most taxa were collected in Atlantic Forest phytogeographical region between 1913 and 1940, and were studied by Father Camille Torrend.

Key words: Diversity, Polypores, Bahia, Brazil.

INTRODUCTION

The knowledge of fungal biodiversity in tropical regions and, especially in Brazil, is still sparce and is practically restricted to specialists' study areas (Hawksworth, 1993; Bicudo & Menezes, 1996).

The State of Bahia (567,295 sq. km), situated in the northeastern part of Brazil, presents an extraordinary variety of tropical ecosystems in a mosaic of distinct phytogeographic regions with typical topographic and climatic aspects, which still certainly harbours several unknown fungal species.

There are, in a broad sense, five principal vegetation types in Bahia: Atlantic Forest, Seasonal Forest, Steppic-Savannah (*Caatinga*), Savannah (C*errado)* and Rocky Fields.

The Atlantic Forest is a typical tropical rain forest consisting of broad-leaved, evergreen trees and a high number of epiphytes. The Seasonal Forest is a transitional forest between extreme (wet and arid) types of vegetation subject to seasonality of rainfall. The Steppic-Savannah is a semi-arid area composed of low thorny shrubs 3-5m in height with a few scattered trees up to 8m tall. The Savannah consists of tortuous trees, occurring isolated or grouped in an open grassland area. The Rocky Field generally occurs at high altitudes where there is a thin layer of soil over solid bedrock. This area is of considerable biogeographical interest since it constitutes a humid region completely surrounded by the dry phytogeographic region of Steppic-Savannah (Brasil, 1981; Noblick, 1991).

Most of our knowledge of polypore diversity in the State of Bahia is from the pioneering studies of Father Camille Torrend (1913, 1914, 1920a, 1920b, 1924, 1926, 1935, 1940). Although dedicating most of his time in educational or religious activities, Torrend contributed significantly to the development of Mycology in Brazil as well as Father Johann Rick, the other Jesuit priest who is considered the "Father of Brazilian Mycology' (Fidalgo, 1962). All of his personal material, including an extensive correspondence with C. G. Lloyd, is preserved in the library of 'Antônio Vieira' school, which is a private institution founded in 1911 in the city of Salvador (the capital of Bahia) by Jesuit priests. Unfortunately the best and most complete biographical paper on Torrend is an unpublished document by one of his former students.[i] Most of Torrend's collected fungi (ca. 4,000) are preserved in URM (Federal University of Pernambuco, Brazil)[ii] and in BPI as part of Lloyd's herbarium. A smaller part (ca. 500) constitutes the 'Father Camille Torrend Fungi Collection' in ALCB (Federal University of Bahia).

The present work is intended to diagnose the polypore biodiversity via an historical review and the results of a recent polypore survey in the State of Bahia, Brazil.

MATERIAL AND METHODS

This paper is a result of three distinct activities:

1. **Historical Review** – Bibliographic inventory of fungi recorded from the State of Bahia;
2. **Recent Taxonomic Survey** – A preliminary survey of polypore species in Biological Reserve of Una (15°06'53", 15°12'29" S lat. ; 39°02'51", 39°12'06" W long.) in one year period (1993-1994) with specimens preserved in ALCB and CEPEC;
3. **Current Situation** – Critical analysis of the current state of knowledge of polypore diversity in the State of Bahia.

RESULTS AND DISCUSSION

1. Historical Review

The studies about fungal diversity in the State of Bahia could be didactically divided in three distinct periods focussing on important Father Camille Torrend' s mycological studies in Bahia:

1.1. PRE-TORRENDIAN PERIOD (1836–1910)

During this period foreign naturalists published some works about fungi collected in Bahia during scientific expeditions in Brazil.

Collections were basically from areas next to the seaside in the municipalities of Salvador and Ilhéus in Atlantic Forest phytogeographic region (Duby, 1836;

Léveillé, 1846; Berkeley & Montange, 1849; Wawra, 1866; Berkeley & Cooke, 1876). In the first decade of the 20th century Hennings (1908) studied microfungi collected in seven municipalities in the Steppic-Savannah phytogeographic region.

A total of 28 taxa were recorded in this period, 72% Basidiomycota, 14% Ascomycota and 14% asexual fungi. Most of them are saprobic macrofungi and phytopathogenic microfungi of native plants. 57% were collected in Atlantic Forest and 43% in Steppic-Savannah. Only eight polypores were recorded for Bahia in this period.

Léveillé (1846) described *Polyporus tricolor* Lév. from a Bahia collection by J.S. Blanchet. Unfortunately the type specimen is lost (Ryvarden, 1981) and Léveillé's description lacks details to precisely characterize the fungus.

Jacques Samuel Blanchet was the most prolific fungal collector in Bahia during the first half of nineteenth century. His collections were mainly sent to Montagne in Paris, who frequently shared them with Berkeley in England. Berkeley and Montagne (1849), studying Blanchet collections, described five new species of polypores.

Wawra (1866) reported two polypores in Ilhéus. Berkeley (1876), studying the fungi collected during the voyage of the "Challenger", described a new polypore from Bahia's material. Berkeley and Cooke (1876) published a list of fungi collected in Brazil which included all eight species previously recorded for Bahia in the aforementioned articles.

The disposition of the names, according to Ryvarden (1977, 1984, 1991) and Nuñez and Ryvarden (1995), the localities, the vegetation type, the citation of the reports and the initial names given these collections are listed below.

POLYPORES COLLECTED IN PRE-TORRENDIAN PERIOD (1836-1910)
1.*Coriolopsis floccosa* (Jungh.) Ryv. Salvador. Atlantic Forest. Berkeley & Montagne, 1849 (*Trametes rigida*)
2. *Ganoderma opacum* (Berk. & Mont.) Pat. Salvador. Atlantic Forest. Berkeley & Montagne, 1849 (*Polyporus opacus*)
3. *Polyporus blanchettianus* Berk. & Mont. Salvador. Atlantic Forest. Berkeley & Montagne, 1849 (*Polyporus blanchettianus*)
4. *Polyporus tenuiculus* (Beauv.) Fr. Salvador. Atlantic Forest. Berkeley & Montagne, 1849 (*Favolus alutaceus*)
5. *Pycnoporus sanguineus* (L.:Fr.) Murr. Ilhéus. Atlantic Forest. Wawra, 1866 (*Polyporus sanguineus*)
6. *Trametes marianna* (Pers.) Ryv. Salvador. Atlantic Forest. Berkeley & Montagne, 1849 (*Polyporus psilodermus*)
7. *Trametes membranacea* (Sw:Fr.) Kreisel Ilhéus. Atlantic Forest. Wawra, 1866 (*Polyporus membranaceus*)
8. *Tyromyces hypocitrinus* (Berk.) Ryv. NI (not indicated). NI. Berkeley, 1876 (*Polyporus hypocitrinus*)

1.2. TORRENDIAN PERIOD (1910–1940)

The beginning of the second decade of the current century marked the start of an admirable advance in the knowledge of mycological diversity in the

State of Bahia due to the dedication of Father Camille Torrend, who was particularly known because of his previous works in myxomycetology as a disciple of Lister.

Torrend published articles in the area of Basic Mycology, mainly in taxonomy, as well as in Applied Mycology, especially in Phytopathology. He began studying the Bahian mycota even before his arrival in Brazil since two of his brothers of faith (Jesuit priests) lived in the State of Bahia and had sent him fungi collected there.

In 1913 and 1914 Torrend published, respectively, his second and third lists of fungi collected in Portugal, Brazil and Portuguese colonies. In the first article (1913) he registered the occurrence of only one polypore. In the second article (1914) he listed 22 taxa of fungi collected in Bahia of which eight are polypores.

After his arrival in Brazil, Torrend studied Brazilian myxomycetes (Torrend, 1915, 1916). In the 1920's Torrend began the publication of a series on polypores which would continue for more than twenty years. Torrend, except for minor disagreements, followed Lloyd's taxonomic arrangement in his papers.

Torrend's (1920a) first paper on Brazilian polypores treats the genus *Ganoderma* Karsten. In this work seven taxa are undoubtedly cited for Bahia

In the same year Torrend (1920b) published on the genus *Amauroderma* Pat. Eight taxa are certainly recorded for Bahia. Furtado (1981), revising the genus *Amauroderma*, analyzed Torrend's original material. He considered *Amauroderma auriscalpium* (Pers) Torrend as a taxon of uncertain affinity and did not mention *Amauroderma picipes* Torrend.

Torrend (1924) continued his work on Brazilian polypores studying the genera *Lignosus* Lloyd ex Torrend, *Petaloides* Lloyd ex Torrend, *Merisma* (Fr.) Gillet and *Spongiosus* Lloyd ex Torrend. Six taxa were surely collected in the State of Bahia.

Next Torrend (1926) described Brazilian species of the genera *Pelloporus* Quél. and *Polyporus* Adans:Fr. section *Ovinus* Lloyd. Five species were with no doubt from Bahia. Ryvarden (1991) considered one of them, *Polyporus globocephalus* Lloyd, a *nomen dubium*.

Nine years later Torrend (1935) published on the Brazilian species of the genus *Hexagonia* Fr. Four species were undoubtedly from Bahia.

During the 1st South-American Botany Reunion in 1938 Torrend presented a paper, published in the Annals of this event (1940), in which he summarized a twenty-three year study of Brazilian polypores mainly collected in Bahia. He presented a key to 206 polypore taxa distributed in the genera *Daedalea, Favolus, Fomes, Ganoderma, Hexagonia, Polyporus, Polystictus, Poria* and *Trametes.*

In order to determine the precise location of collections as well as to supplement information in the articles, Torrend's books, letters, and field annotations were often consulted. The following pages consist of an alphabetical list for the accepted names, in conformity with Furtado (1981), Ryvarden (1991) and Nuñez & Ryvarden (1995), localities, vegetational type and original citation for Torrend's records.

POLYPORES COLLECTED IN TORRENDIAN PERIOD (1910-1940)

1. *Abortiporus biennis* (Bull:Fr.) Sing. NI (not indicated). NI (not indicated). (*Spongiosos ballouii*, 1924)[iii]
2. *Amauroderma auriscalpium* (Pers.) Torrend Gongogi. Atlantic Forest. (*Polyporus auriscalpium*, 1940)
3. *Amauroderma boleticeum* (Pat. & Gaill.) Torrend Gongugi. Atlantic Forest. (*Amauroderma boleticeum*, 1926); Gongugi. Atlantic Forest. (*Polyporus pallidosporus*, 1940)
4. *Amauroderma calcigenum* (Berk.) Torrend Cachoeira. Seasonal Forest. (*Amauroderma calcigenum*, 1920b); NI. NI. (*Polyporus gracilis, Polyporus exilis*, 1940)
5. *Amauroderma camerarium* (Berk.) J. Furtado NI. NI. (*Polyporus variabilis*, 1940)
6. *Amauroderma exile* (Berk.) Torrend Jiquiriça. Atlantic Forest. (*Polyporus marasmioides*, 1940); NI. NI. (*Polystictus renatus, Polystictus exilis*, 1940)
7. *Amauroderma fractipes* (Berk. & Curt.) Gilbn. & Ryv. Salvador. Atlantic Forest. (*Polyporus fractipes*, 1940)
8. *Amauroderma omphalodes* (Berk.) Torrend NI. NI. (*Amauroderma omphalodes*, 1920b)
9. *Amauroderma renidens* (Bres.) Torrend Gongogi. Atlantic Forest. (*Polyporus renidens*, 1940)
10. *Amauroderma rude* (Berk.) Torrend Salvador. Atlantic Forest. (*Amauroderma rude*, 1920b)
11. *Amauroderma schomburgkii* (Mont. & Berk.) Torrend Cachoeira. Seasonal Forest. (*Amauroderma schomburgkii*, 1920b); Uruçuca. Atlantic Forest. (*Amauroderma schomburgkii*, 1920b); Ilhéus. Atlantic Forest. (*Polyporus mosselmani*, 1940); NI. NI. (*Polystictus heteromorphus, Polystictus schombergii, Trametes ocellata*, 1940)
12. *Amauroderma* sp. NI. NI. (*Pelloporus lignicola*, 1926); Contendas do Sincorá. Steppic-Savannah. (*Polyporus lignicola*, 1940)
13. *Amauroderma unilaterus* (Lloyd) Ryv. NI. NI. (*Polyporus unilaterum*, 1940)
14. *Antrodiella liebmanii* (Fr.) Ryv. Gongugi. Atlantic Forest. (*Petaloides stereinus*, 1924); Gongugi. Atlantic Forest. (*Polystictus stereinus*, 1940)
15. *Bjerkandera adusta* (Wild.:Fr.) Karsten Jiquiriça. Atlantic Forest. (*Polyporus crispus*, 1940)
16. *Bondarzewia guaiatacasensis* (Henn.) Singer NI. NI. (*Polyporus guaitacasensis*, 1940)
17. *Byssomerulius corium* (Fr.) Parm. Salvador. Atlantic Forest. (*Polystictus eriophorus*, 1914)
18. *Coriolopsis floccosa* (Jungh.) Ryv. NI. NI. (*Polystictus rigens*, 1940)
19. *Coriolopsis polyzona* (Pers.) Ryv. NI. NI. (*Polystictus occidentalis*, 1940)
20. *Coriolopsis sp.* NI. NI. (*Trametes hispidula*, 1940)
21. *Cyclomyces iodinus* (Mont.) Pat. Itaparica. Atlantic Forest. (*Polystictus iodinus*, 1940)
22. *Cyclomyces tabacinus* (Mont.) Pat. NI. NI. (*Polystictus tabacinus*, 1940)

23. *Daedalea aethalodes* (Mont.) Rajch. NI. NI. (*Trametes argiropotamica, T. citrina*, 1940)
24. *Daedalea sprucei* Berk. NI. NI. (*Daedalea fusco-stratosa, D. sprucei*,1940)
25. *Datronia caperata* (Berk.) Ryv. Caitité. Steppic-Savannah. (*Polyporus caperatus*, 1914); NI. NI. (*Polystictus caperatus, Polystictus phocinus* 1940)
26. *Dictyopanus rhipidium* (Berk.) Pat. NI. NI. (*Polyporus rhipidium*, 1940)
27. *Echinochaete brachyporus* (Mont.) Ryv. Ilhéus. Atlantic Forest. (*Polyporus brachyporus*, 1940); NI. NI. (*Favolus megaloporus*, 1940)
28. *Echinopora aculeifera* (Berk. & Curt.) Ryv. Gongogi. Atlantic Forest. (*Polystictus aculeifer*, 1940)
29. *Fomes fasciatus* (Schw.:Fr.) Cke. Jiquiriça. Atlantic Forest. (*Fomes marmoratus*, 1940)
30. *Fomitella feei* (Fr.) Kreisel Cachoeira. Seasonal Forest. (*Trametes feei*, 1940)
31. *Fomitella supina* (Sw.:Fr.) Murr. Gongogi. Atlantic Forest. (*Polyporus supinus*, 1940); NI. NI. (*Polyporus valenzuelianus*, 1940)
32. *Ganoderma applanatum* (Pers.) Pat. NI. NI. (*Ganoderma applanatum*, 1920a, 1940); NI. NI. (*Ganoderma leucophaeum*, 1940)
33. *Ganoderma tornatum* (Pers.) Bres. NI. NI. (*Ganoderma australe*, 1940)
34. *Ganoderma colossum* (Fr.) C.F. Baker NI. NI. (*Ganoderma colossum*, 1920a); Ilhéus. Atlantic Forest. (*Ganoderma colossum*, 1940)
35. *Ganoderma curtisii* (Berk.) Murr. NI. NI. (*Ganoderma curtisii*, 1940)
36. *Ganoderma dorsale* (Lloyd) Rick Gongogi. Atlantic Forest. (*Ganoderma dorsale*, 1920a, 1940)
37. *Ganoderma lobatum* (Schw.) Atk. NI. NI. (*Ganoderma reniforme*, 1920a)
38. *Ganoderma lucidum* (W. Curt:Fr.) Karsten Gongugi. Atlantic Forest. (*Ganoderma lucidum*, 1920a); NI. NI. (*Ganoderma lucidum*, 1940)
39. *Ganoderma oerstedii* Fr. NI. NI. (*Ganoderma oerstedii*, 1920a, 1940)
40. *Ganoderma opacum* (Berk. & Mont.) Pat. NI. NI. (*Ganoderma opacum*, 1920a)
41. *Gloeoporus dichrous* (Fr.) Bres. NI. NI. (*Polyporus dichrous*, 1940)
42. *Gloeoporus thelephoroides* (Hook) Cunn. NI. NI. (*Polyporus conchoides*, 1940)
43. *Gloephyllum striatum* (Sw:Fr.) Murr. NI. NI. (*Lenzites striata*, 1913)
44. *Hapalopilus nidulans* (Fr.) Karst. NI. NI. (*Polyporus pallido-cervinus*, 1940)
45. *Henningsia brasiliensis* (Speg.) Speg. Salvador. Atlantic Forest. (*Polyporus brasiliensis*, 1940)
46. *Heterobasidion annosum* (Fr.) Bref. Jiquiriça. Atlantic Forest. (*Fomes annosum*, 1940)
47. *Hexagonia capillacea* Pat. & Gaill. Itaparica. Atlantic Forest. (*Hexagonia capillacea*, 1935); Vitória da Conquista. Seasonal Forest. (*Hexagonia capillacea*, 1940)
48. *Hexagonia hydnoides* (Fr.) Fidalgo Caitité. Steppic-Savannah. (*Trametes hydnoides*, 1914); NI. NI. (*Trametes hydnoides*, 1940)
49. *Hexagonia leprosa* Fr. Jiquiriça. Atlantic Forest. (*Hexagonia leprosa*, 1935); Gongugi. Atlantic Forest. (*Hexagonia leprosa*, 1940)

50. *Hexagonia papyracea* Berk. Caitité. Steppic-Savannah. (*Hexagonia variegata*, 1914)
51. *Hexagonia tenuis* (Hook) Fr. Itaeté. Steppic-Savannah. (*Hexagonia aculeata*, 1935); Itaparica. Atlantic Forest. (*Hexagonia aculeata*, 1935, 1940); NI. NI. (*Polystictus tenuis*, 1940)
52. *Humphreya coffeatum* (Berk.) Stey. Salvador. Atlantic Forest. (*Amauroderma infulgens*, 1920b); Salvador. Atlantic Forest. (*Polyporus infulgens*, 1940)
53. *Hydnopolyporus fimbriatus* (Fr.) Reid NI. NI. (*Polystictus fimbriatus*, 1940)
54. *Inonotus patouillardii* (Rick) Imaz. Jaguaripe. Atlantic Forest. (*Polyporus patouillardii*, 1940)
55. *Inonotus radiatus* (Sch.:Fr.) Karst. NI. NI. (*Polyporus gilvoides*, 1940)
56. *Inonotus splitbergeri* (Mont.) Ryv. NI. NI. (*Polyporus rheicolor*, 1940)
57. *Laetiporus sulphureus* (Bull.:Fr.) Murr. NI. NI. (*Polyporus sulphureus*, 1940)
58. *Lenzites stereoides* (Fr.) Ryv. NI. NI. (*Daedalea stereoides*, 1940)
59. *Loweporus infibilis* (Berk.) Ryv. NI. NI. (*Fomes glaucoporus*, 1940)
60. *Microporus affinis* (Fr.:Bl. & Nees) Kunt. NI. NI. (*Polystictus flabelliformis*, 1940)
61. *Microporus friesii* (Klotz.) Ryv. NI. NI. (*Polystictus elongatus*, 1940)
62. *Microporus obovatus* (Jungh.) Ryv. Salvador. Atlantic Forest. (*Polyporus subfulvus*, 1940); Cachoeira. Seasonal Forest. (*Polystictus mutabilis*, 1940); NI. NI. (*Polystictus porphyriti*, 1940)
63. *Nigrofomes melanoporus* (Mont.) Murr. Gongogi. Atlantic Forest. (*Fomes melanoporus*, 1940)
64. *Nigroporus vinosus* (Berk.) Murr. NI. NI. (*Polyporus vinosus*, 1940)
65. *Oligoporus caesius* (Schrad.:Fr.) Gilbn. & Ryv. NI. NI. (*Polyporus caesius*, 1940)
66. *Oxyporus latemarginatus* (Dur. & Mont.) Donk NI. NI. (*Poria ambigua*, 1940)
67. *Perenniporia infibilis* (Berk.) Ryv. Cachoeira. Seasonal Forest. (*Fomes minutulus*, 1940)
68. *Perenniporia martius* (Berk.) Ryv. Gongogi. Atlantic Forest. (*Fomes hornodermus*, 1940)
69. *Perenniporia medulla-panis* (Fr.) Donk NI. NI. (*Poria medulla-panis*, 1940)
70. *Perenniporia ochroleuca* (Berk.) Ryv. NI. NI. (*Trametes coriacea*, 1940)
71. *Perenniporia ohiensis* (Berk.) Ryv. NI. NI. (*Fomes ohiensis*, 1940)
72. *Phaeolus schweinitzii* (Fr.) Pat. NI. NI. (*Polyporus schweinitzii*, 1940)
73. *Phaeotrametes decipiens* (Berk.) Wright Ilhéus. Atlantic Forest. (*Trametes praetervisa*, 1940)
74. *Phellinus badius* (Cke.) Cunn. NI. NI. (*Fomes badius*, 1940)
75. *Phellinus caryophylleus* (Cke.) Ryv. NI. NI. (*Fomes caryophylleus*, 1940)
76. *Phellinus caryophylli* (Racib.) Cunn. Ilhéus. Atlantic Forest. (*Fomes caryophylli*, 1940)
77. *Phellinus contiguus* (Fr.) Pat. NI. NI. (*Poria contigua*, 1940)
78. *Phellinus discipes* (Berk.) Ryv. NI. NI. (*Polystictus discipes*, 1940)

79. *Phellinus fastuosus* (Lév.) S. Ahmad Gongogi. Atlantic Forest. (*Fomes endotheius*, 1940)
80. *Phellinus gilvus* (Schw.:Fr.) Pat. Caitité. Steppic-Savannah. (*Polyporus gilvus*, 1914); NI. NI. (*Fomes gilvus*, *Polyporus licnoides*, *Polyporus scruposus* 1940)
81. *Phellinus inamaenus* (Mont.) Ryv. NI. NI. (*Polyporus inamaenus*, 1940)
82. *Phellinus lamaensis* (Murr.) Heim NI. NI. (*Fomes lamaensis*, 1940)
83. *Phellinus nilgheriensis* (Mont.) Cunn. Ilhéus. Atlantic Forest. (*Fomes pseudo-senex*, 1940)
84. *Phellinus rhabarbarinus*((Berk.) Cunn. NI. NI. (*Fomes rheicolor*, *F. rhabarbarinus*, 1940)
85. *Phellinus rimosus* (Berk.) Pil. Caitité. Steppic-Savannah. (*Fomes rimosus*, 1940)
86. *Phellinus robiniae* (Murr.) Ames NI. NI. (*Fomes robiniae*, 1940)
87. *Phellinus senex* (Nees & Mont.) Imazeki Cachoeira. Seasonal Forest. (*Fomes senex*, 1940)
88. *Phellinus torulosus* (Pers.) Bourd. & Galz. NI. NI. (*Fomes torulosus*, 1940)
89. *Phellinus umbrinellus* (Bres.) Ryv. NI. NI. (*Poria umbrinella*, 1940)
90. *Phylloporia chrysita* (Berk.) Ryv. NI. NI. (*Polyporus pseudo-fruticum*, 1940)
91. *Phylloporia frutica* (Berk. & Curt.) Ryv. NI. NI. (*Polyporus fruticum*, 1940)
92. *Phylloporia pectinata* (Kl.) Ryv. NI. NI. (*Fomes pectinatus*, 1940)
93. *Phylloporia spathulata* (Hook.) Fr. Salvador. Atlantic Forest. (*Polyporus luteo-nitidus*, 1926); Salvador. Atlantic Forest. (*Polyporus multiformis*, 1940)
94. *Physisporinus sanguinolentus* (Alb. & Schw.) Pil. NI. NI. (*Poria sanguinolenta*, 1940)
95. *Polyporus arcularius* Fr. NI. NI. (*Polyporus arcularius*, 1940)
96. *Polyporus dictyopus* Mont. Gongogi. Atlantic Forest. (*Polyporus dictyopus*, 1940); NI. NI. (*Polyporus dictyopus*, 1940)
97. *Polyporus grammocephalus* Berk Gongugi. Atlantic Forest. (*Polyporus grammocephalus*, 1924, 1940); Ilhéus. Atlantic Forest. (*Polyporus melanoporus*, 1940)
98. *Polyporus guianensis* Mont. Gongogi. Atlantic Forest. (*Polystictus guyanensis*, 1940); Salvador. Atlantic Forest. (*Polyporus puttemansii*, 1940)
99. *Polyporus leprieurii* Mont. Gongogi. Atlantic Forest. (*Polyporus leprieuri*, 1940)
100. *Polyporus sapurema* Möller NI. NI. (*Polyporus sapurema*, 1940)
101. *Polyporus squamosus* Huds.:Fr. NI. NI. (*Polyporus squamosus*, 1926); Ilhéus. Atlantic Forest. (*Polyporus squamosus*, 1940)
102. *Polyporus tenuiculus* (Beauv.) Fr. Caitité. Steppic-Savannah. (*Favolus giganteus*, 1914); Gongogi. Atlantic Forest. (*Favolus tesselatus*, 1940); NI. NI. (*Favolus dermoporus*, *F. flacidus*, 1940)
103. *Polyporus virgatus* Berk. & Curt. NI. NI. (*Polyporus guaraniticus*, 1940)
104. *Porogramme graphica* (Bres.) Pat. NI. NI. (*Poria graphica*, 1940)
105. *Protomerulius substuppeus* (Berk. & Cke.) Ryv. Jiquiriça. Atlantic Forest. (*Polyporus altocedronensis*, 1940)

106. *Pseudofavolus cucullatus* (Mont.) Pat. Vitória da Conquista. Seasonal Forest. (*Hexagonia cucullata*, 1935, 1940)
107. *Pycnoporus sanguineus* (L.:Fr.) Murr. NI. NI. (*Polystictus sanguineus*, 1940)
108. *Pyrofomes fulvo-umbrina* (Bres.) David & Rajch. Salvador. Atlantic Forest. (*Fomes fulvo-umbrina*, 1940); NI. NI. (*Poria fulvo-umbrina*, 1940)
109. *Rigidoporus lignosus* (Klotz.) Imazeki Gongogi. Atlantic Forest. (*Fomes lignosus*, 1940)
110. *Rigidoporus lineatus* (Pers.) Ryv. Gongogi. Atlantic Forest. (*Polyporus zonalis*, 1940)
111. *Rigidoporus undatus* (Pers.:Fr.) Donk NI. NI. (*Polyporus undatus*, 1940)
112. *Skeletocutis amorphus* (Fr.) Kotl. & Pouz. Caetité. Steppic-Savannah. (*Polyporus sublilacinus*, 1940)
113. *Skeletocutis roseolus* (Theissen) Rajch. NI. NI. (*Polystictus roseolus*, 1940)
114. *Spongipellis fractipes* (Berk.) Kotl. & Pouz. NI. NI. (*Petaloides fractipes*, 1924); Salvador. Atlantic Forest. (*Polyporus fractipes*, 1940)
115. *Trametes cubensis* (Mont.) Sacc. Jiquiriça. Atlantic Forest. (*Trametes cubensis*, 1940)
116. *Trametes cupreo-rosea* (Berk.) Lloyd NI. NI. (*Trametes cupreo-rosea* 1940)
117. *Trametes elegans* (Spreng.:Fr.) Fr. NI. NI. (*Trametes lactea*, 1940)
118. *Trametes hirsuta* (Wulf.:Fr.) Pil. NI. NI. (*Polystictus cryptomeriae*, 1940)
119. *Trametes marianna* (Pers.) Ryv. NI. NI. (*Polystictus psilodermus*, 1940)
120. *Trametes membranacea* (Sw.:Fr.) Kreisel NI. NI. (*Polystictus membranaceus*, 1914, 1940)
121. *Trametes menziesii* (Berk.) Ryv. NI. NI. (*Polystictus didricasenii*, 1940)
122. *Trametes meyenii* (Klotz.) Bakshi NI. NI. (*Trametes meyenii*, 1940)
123. *Trametes modesta* (Kunze:Fr.) Ryv. NI. NI. (*Petaloides modestus*, 1924); Ilhéus. Atlantic Forest. (*Polyporus modestus*, 1940)
124. *Trametes nivosa* (Berk.) Murr. Gongogi. Atlantic Forest. (*Polyporus nivosus*, 1940)
125. *Trametes ochroflava* Cke. Ilhéus. Atlantic Forest. (*Fomes ochroflavus*, 1940)
126. *Trametes scabrosa* (Mont.) Cunn. Gongogi. Atlantic Forest. (*Trametes personii*, 1940)
127. *Trametes sp.* Jiquiriça. Atlantic Forest. (*Polyporus immaculatus*, 1940)
128. *Trametes villosa* (Fr.) Kreisel Caitité. Steppic-Savannah. (*Polystictus pinsitus*, 1914); Ilhéus. Atlantic Forest. (*Polystictus villosus*, 1940)
129. *Trichaptum biforme* (Fr.) Ryv. Salvador. Atlantic Forest. (*Polyporus friesii*, 1940)
130. *Trichaptum byssogenus* (Jungh.) Ryv. Ilhéus. Atlantic Forest. (*Polystictus versatilis*, 1940);
131. *Trichaptum perrottetti* (Lév.) Ryv. Ilhéus. Atlantic Forest. (*Polystictus trichomallus*, 1940)
132. *Trichaptum sector* (Ehr.:Fr.) Kreisel Gongogi. Atlantic Forest. (*Polystictus sector*, 1940)

133. *Tyromyces tephronotus* (Berk.) Cunn. NI. NI. (*Polyporus tephronotus*, 1940)

1.3. POST-TORRENDIAN PERIOD (AFTER 1940)

During this period there has been several direct or indirect contributions of few researchers to the knowledge of Bahian fungal biodiversity (Bastos, 1975; Gottsberger, 1968; Matta, 1954, 1955, 1956, 1961, 1974; Ram, 1969, 1970; Silva & Minter, 1995). Except for Gottsberger's investigation of myxomycetes in the Steppic-Savannah region, the other articles treat phytoparasitic microfungi on cultivated or native plants.

2. Recent Survey at Una, Bahia

The present work intended, besides the historical view, to reinitiate the inventory of Bahian polypores. A survey of common macrofungi (Phyla Ascomycota and Basidiomycota) in Biological Reserve of Una in Atlantic Forest phytogeographic region was carried out.
The Reserve is a forest fragment of approximately 11,400 ha. situated in the South of Bahia. The vegetation of the area, which is a typical well preserved tropical rainforest, is characterized by rapid growing trees without an emergent canopy and many palms, mainly *Attalea funifera* Mart. (BRASIL, 1981). The survey of this area is justified by the fact that, in the period 1945 to 1990, the South Bahian Tropical Rainforest was drastically reduced to only 6,0% of its original area.[iv]

Collections were made during a period of 1 year (1993-1994) every three months, comprising all seasons. Macroscopic, microscopic and chemical features were analyzed. Slide preparations were stained with 1% phloxine, 5% KOH, and Melzer's reagent was used to test iodine reaction. All the specimens collected were primarily deposited in ALCB (Federal University of Bahia) with duplicates in CEPEC. Nine polypores were collected and identified in this fieldwork. Taxa in bold are new citations for Bahia.

1. *Amauroderma omphalodes* (Berk.) Torrend Góes-Neto, A. 15 (27/VII/93)
2. ***Amauroderma praetervisum* (Pat.) Torrend** Góes-Neto, A. 73 (14/IX/93)
3. *Ganoderma tornatum* (Pers.) Bres. Góes-Neto, A. 49 (28/VII/93), 75 (14/IX/93), 88 (15/IX/93)
4. ***Ganoderma* aff. *truliforme* Steyart** Góes-Neto, A. 48 (14/IX/93)
5. ***Phellinus* aff. *piptadeniae* Teixeira** Góes-Neto, A. 42 (28/VII/93)
6. ***Phellinus* aff. *sancti-georgii* (Pat.) Ryv.** Góes-Neto, A. 50 (28/VII/93)
7. ***Phellinus wahlbergii* (Fr.) Reid** Góes Neto, A. 113 (29/XII/93)
8. *Pycnoporus sanguineus* (L.:Fr.) Murr. Góes-Neto, A. 55, 69 (28/VII/93)
9. *Trametes cupreo-rosea* (Berk.) Lloyd Góes-Neto, A. 23 (27/VII/93), 54 (28/VII/93), 82, 90 (15/IX/93), 179 (29/VIII/94)

The preliminary survey yielded five taxa not previously reported in Bahia. Thus demonstrating that knowledge about Bahian polypore diversity had been, and probably still is, incomplete.

3. Current Situation

The knowledge of biodiversity of polypores in the State of Bahia is still fragmentary. The majority of taxa recorded from Bahia appear in Father Camille Torrend's publications (1920-1940). The records were restricted to only 13 municipalities in the State of Bahia and most specimens were collected in Atlantic Forest phytogeographical region (Fig.1). A total of 139 taxa are cited for the State of Bahia: 8 taxa in the Pre-Torrendian Period, 133 in Torrendian Period, 9 in Post-Torrendian Period with 11 taxa recorded in two different periods.

The recorded taxa are distributed among nine families (following Hawksworth et al., 1995): (a) **Coriolaceae** (29 genera) – *Abortiporus, Bjerkandera, Coriolopsis, Daedalea, Datronia, Echinopora, Fomes, Fomitella, Gloeophyllum, Henningsia, Heterobasidion, Hexagonia, Hydnopolyporus, Laetiporus, Lenzites, Loweporus, Nigrofomes, Nigroporus, Perenniporia, Phaeolus, Physisporinus, Pycnoporus, Pyrofomes, Rigidoporus, Skeletocutis, Spongipellis, Trametes, Trichaptum, Tyromyces*; (b) **Hymenochaetaceae** (4 genera) – *Cyclomyces, Inonotus, Phellinus, Phylloporia*; (c) **Polyporaceae** (4 genera) – *Echinochaete, Microporus, Polyporus, Phaeotrametes*; (d) **Ganodermataceae** (3 genera) – *Amauroderma, Ganoderma, Humphreya*; (e) **Meruliaceae** (2 genera) – *Byssomerulius, Gloeoporus*; (f) **Grammotheleaceae** (1 genus) – *Porogramme*; (g) **Bondarzewiaceae** (1 genus) – *Bondarzewia*; (h) **Exidaceae** (1 genus) – *Protomerulius*; (i) **Tricholomataceae** (1 genus) – *Dictyopanus*.

Phellinus is the most diverse genus with 19 taxa. The genera *Trametes, Amauroderma, Ganoderma* and *Polyporus* are represented by more than 8 species each. These genera (except the exclusively pantropical *Amauroderma*) have more tropical species than in the temperate zone (Ryvarden, 1993).

This paper orders our knowledge of polypore biodiversity. Inventories in less explored phytogeographical regions are necessary to a more concise image of the numbers and distribution of the polypores.

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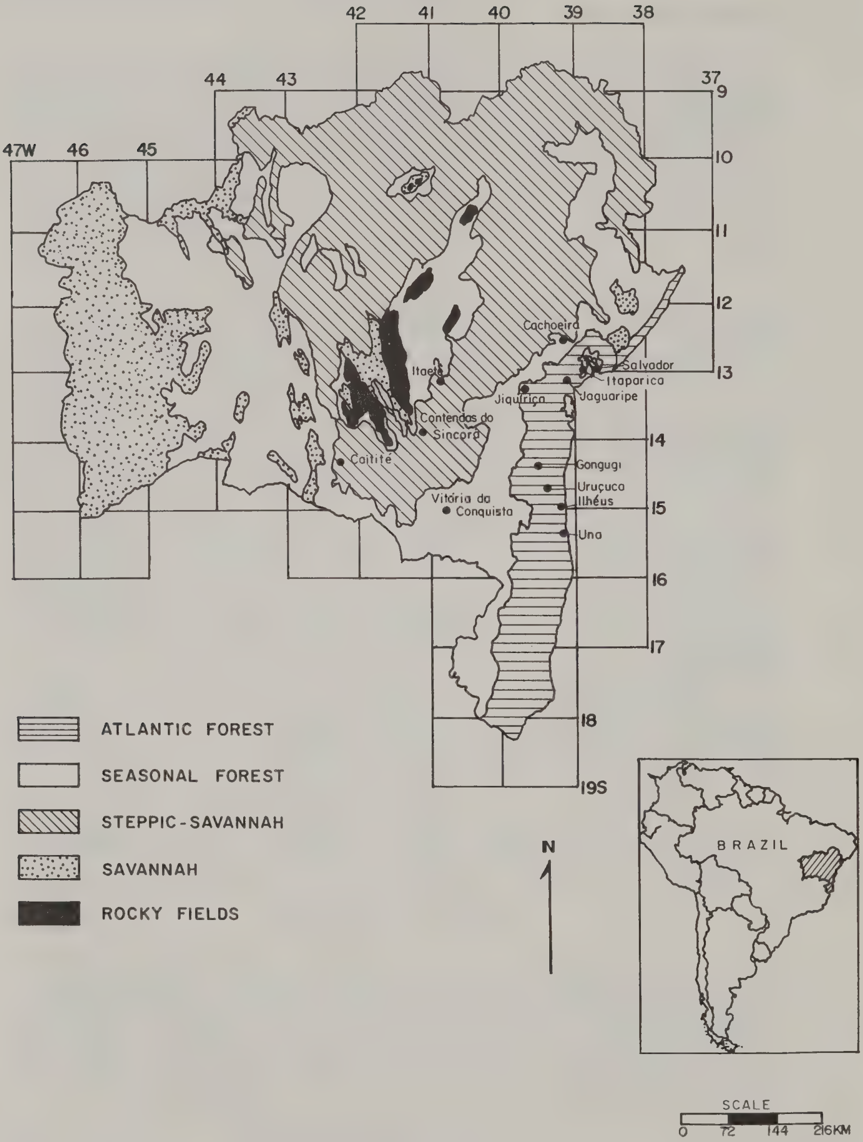
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Salvador
Itaparica
Jaguaripe
Jiquiriça
Itaetê
Contendas do Sincorá
Caitité
Gongugi
Uruçuca
Ilhéus
Vitória da Conquista
Una
ATLANTIC FOREST
SEASONAL FOREST
STEPPIC-SAVANNAH
SAVANNAH
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BRAZIL
SCALE
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144
216KM

FIG. 1. AREAS WITH RECORDED POLYPORE TAXA IN THE STATE OF BAHIA, BRAZIL.
(modified from, NOBLICK, 1991).

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[i] It is the transcription of Prof. Alexandre Leal Costa's (Former Professor of Botany in Federal University of Bahia) oral presentation entitled 'Padre Camilo Torrend, o naturalista' in 21/VI/1975 during the commemoration of Torrend's hundred years birth in the Historic and Geographic Institute of Bahia.

[ii] By that time (1960s) the curator of the URM Herbarium was Prof. Augusto Chaves Batista, a well known Brazilian phytopathologist and mycologist, who was a 'scientific son' of Torrend.

[iii] The years refer to Torrend's papers in the Literature Cited.

[iv] *45 years of deforestation in the South of Bahia.*. 1994. 'Mata Atlântica Nordeste' Project. Centro de Pesquisas do Cacau (CEPEC) and New York Botanical Garden (NYBG). Maps of the South of the State of Bahia (Brazil) based in aerial and satellital photographs in the years 1945, 1960, 1974 and 1990.

MYCOTAXON

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TAXONOMIC AND MYCOGEOGRAPHIC NOTES ON SOME MALAYSIAN FUNGI IV. NOTES ON CLITOPILUS AND RHODOCYBE

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ABSTRACT. Descriptions of three new taxa of Entolomataceae are presented, *Clitopitus apalus* var. *macrosporus*, *C. orientalis* and *Rhodocybe perplexa*. Several other species of *Clitopilus* are discussed and a key to taxa of *Clitopilus* found in or around Malaysia is provided.

Introduction

Certain components of the Malaysian macromycota are rather well known from the intensive work of the late E. J. H. Corner, and summarized by Hawksworth (1993) as well as Corner himself (Corner 1993), and more recently by Watling & Ginns (1998) and Watling (ined.). Corner' s pioneer work has been continued by Watling and his collaborators in an on-going series of papers (Watling, 1995; Watling & Lee, 1996; Rutter & Watling, 1997; and Turnbull & Watling, ined.). These studies indicate that the macromycota of Malaysia is very rich and that there is still much to do to catalogue the fungal biodiversity of this region.

Although certain members of the Entolomataceae from Indomalayia and Australasia have received some study (Horak, 1979a and 1980; Rutter & Watling, 1997), the genus *Clitopilus* has not been considered previously. This paper addresses that derth of information on *Clitopilus*, which displays several commonly collected species in these rainforests. A new species of *Rhodocybe,* which tends to be less common, is also described.

Corner was able to collect over long periods of time in a single locality and also had the opportunity to collect in many different localities throughout Indonesia. In contrast, Watling has concentrated his attention on two sites in Malaysia, one in a secondary rainforest and the other in a mosaic of logged and unlogged dipterocarp forests. The first collecting area is situated near Kuala Lumpur and stands on former sites of both agricultural land and tin mining areas which subsequently have been invaded by rainforest. In this area, exotic rainforest trees have been planted within the system, often in small groves, in order to ascertain their quality of growth and usefulness. This secondary rainforest is part of the Forest Research Institute Malaysia (FRIM) facilities and falls within the Greater Templer National Park. The second site lies in the central hills of the Peninsula of Malaysia, approximately 170 km south of Kuala Lumpur, and consists of natural lowland dipterocarp forests. This site contains areas which have been managed for forestry purposes in former times. The site has been intensively monitored for over fifty years to learn more about the organisms of this ecosystem, although fungi only recently have been considered in this study on biodiversity.

MATERIALS AND METHODS

Methods used in preparation of microscopic structures for data collection were those of Baroni (1981). All measurements of microscopic structures were made in mounts of 10% NH_4OH or 3% KOH. The measurement of basidiospores includes the hilar appendix or apiculus. The designations used for basidiospore measurements are those of Baroni & Horak (1994), with the addition of the notation n/7 = 149 indicating that 149 spores were measured from 7 different collections. All measurements were made with an Olympus BHS light microscope under Hoffman interference optics using a semi-automated image analysis system (a GTCO digitizer pad and Metrics5 software written by Dr. David Malloch). Descriptive statistical analysis of the measurements was obtained using EXCEL 5.0 and SigmaStat 1.0. Scanning electron micrographs were produced with an ISI Supra IIIA scanning electron microscope generally run at 10 Kev. Methods for preparation of samples for SEM are those of Baroni (1981).

DESCRIPTIONS OF SPECIES

1. NEW TAXA

Clitopilus orientalis **Baroni & Watling,** ***sp. nov.*** Figs. 1-4, 18

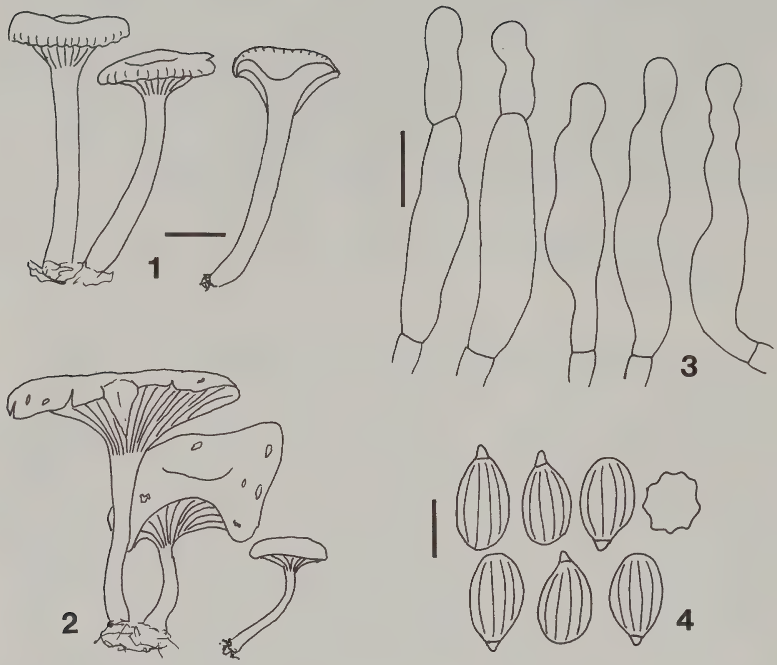
Pileus albus, in madido supra discum subtiliter colorem eburneum vel cremeum tinctus, 12-40 mm latus, primo convexus deinde plano-convexus, discum subdepressum formans, margine incurva et saepe radiatim porcata, siccus, glaber vel subimplexus sericeo-fibrillosus. Contextus albus, 3 mm crassus. Lamellae primo albae deinde pallide bubalinae vel roseo-buballinae, subdecurrentes deinde profunde decurrentes, approximatae vel aggregatae, usque 3 mm latae. Stipes albus vel sub vetustate super basem colorem cremeum tinctus, in apice 3-8 mm latus, 15-20 mm longus, centralis vel subexcentricus, aequus, glaber. Et odor et sapor valde farinaceus vel saponaceo-farinaceus. Basidiospores quum depositum rubellae, 6-9 x 3.8-5.5 mm (Q = 1.65: E = 1.42-1.96), in aspectu frontali et obliquo ellipsoideae vel *brevi-ellipsoideae, porcis longitudinalibus manifestis, in aspectu polari valde angulatis, 8-11 paginulis praeditis. Basidia 20-28 x 7-9 mm, clavata, 4-sterigmatiphora. Pleurocystidia absentia. Cheilocystidia 23-45 x 6-9 mm, late sparsa, interdum absentia, 10 - 25 mm procurrentia, cylindrica vel ventricoso-rostrata vel anguste clavata vel cylindrico-subcapitata, saepe regionibus apicalibus undulatis vel contortis septatis tenuitunicatis hyalinis praeditae. Pileipellis stratum hyalinum e hyphis repentibus cylindricis non-incrustatis compositum formans, 2-5 mm diametro, cellulas terminales sparsas plusminusve ascendentes hyalinas producens. Fibulae absentes.*

Holotypus: R. Watling 24498, Malaysia, Selangor, Kepong; Forest Research Institute Malaysia (E).

Pileus (Figs. 1, 2)white or chalk white, when wet occasionally with a hint of ivory or cream-colour over disc, 12-40 mm broad, convex at first, becoming plano-convex, with a shallow or more deeply depressed disc with expansion, often radiately ridged or fluted over incurved margin or margin smooth and only faintly striate, smooth over disc, dry, glabrous or with center slightly matted silky fibrillose, surface occasionally with watery spots. ***Context*** white, up to 3 mm thick. ***Lamellae*** white becoming pale buff or pinkish buff, subdecurrent at first, becoming deeply decurrent, close to crowded, up to 3 mm broad, edges even, concolorous. ***Stipe*** white overall or developing a blush of creamy pinkish hues over the lower portions, 3-8 mm broad at apex, 15-30 mm long, mostly central, some slightly eccentric, equal but often with a slightly tapered base, glabrous, white and solid within. ***Odor*** and ***Taste*** strong farinaceous or soapy farinaceous (not pleasant). ***Basidiospores*** (Figs. 4, 18) pinkish in deposit, 6-9 x 3.8-5.5 µm (n/7 = 149, $L^m = 7.48 \pm 0.63$, $W^m = 4.53 \pm 0.32$, E = 1.42-1.96, $Q^m = 1.65$), ellipsoid or short-ellipsoid in profile and face view, with obvious longitudinal ridges in profile view, strongly angled in polar view, typically with 8-11 facets. ***Basidia*** 20-28 x 7-9 µm, clavate, 4-sterigmate. ***Pleurocystidia*** absent. ***Cheilocystidia*** (Fig. 3) 23-45 x 6-9 µm, widely scattered (mount whole pieces of lamella edge), occasionally absent, projecting 10-25 µm, cylindric or ventricose-rostrate or narrowly clavate or cylindric-subcapitate, apical regions often undulate or contorted, often septate, thin-walled, hyaline. ***Lamella trama*** of parallel, cylindric, hyaline hyphae, 3.2-10 µm in diam. ***Pileipellis*** a hyaline layer of repent, cylindric non-encrusted hyphae, 2-5 µm in diam, producing scattered ± ascendant, hyaline end cells. ***Context*** of radially arranged or slightly interwoven, hyaline, cylindric or inflated hyphae, 5-14 µm in diam. ***Stipitipellis*** a hyaline layer of compact, repent, cylindric hyphae, 2-7.5 µm in diam; at apex producing erect cylindric, septate, thin-walled, hyaline end cells, 16-40 x 4-5.5 µm. ***Clamp connections*** absent.

Gregarious or scattered on soil, leaf and twig debris, or termite mounds. March-June.

Material examined: MALAYSIA. Selangor. Kepong. Forest Research Institute Malaysia, on termite mound, 13 March 1992, *Watling 24497* (E); same locality, on termite mound, 17 March 1992, *Watling 24498* (E, HOLOTYPE);



Figs. 1-4. *Clitopilus orientalis*: Fig. 1. Young basidiomata (Watling 25155). Fig. 2. Mature basidiomata (Watling 25154). Fig. 3. Cheilocystidia (Holotype). Fig. 4. Basidiospores (Holotype). Horizontal scale bar = 10 mm for Figs. 1-2. Scale bar for Fig. 3 = 10 μm, for Fig. 4 = 5 μm.

same general locality, on trail side on clay soil, 27 March 1993, *Watling 25154*; same general locality, on soil of bank above Forest Research Laboratories, among leaves and twigs, 27 March 1993, *Watling 25155* (E); same general locality, on ground in grassy area, between laboratories at Forest Research Institute, 2 April 1993, *Watling 25156* (E). Negri Sembilan. Pasoh Forest Reserve, Pasoh Field Station, on trail side, 17 March 1992, *Watling 24500* (E); ***Material of additional taxa examined***: INDIA. Kerala Province. Calicut University Campus, on the ground in moist shaded area, 9 June 1980, *Little Flower 417* (NY).

We have found cheilocystidia present in the collections of *C. orientalis* studied from India and Malaysia. However, these cheilocystidia are often not obvious because they typically do not project conspicuously beyond the other hymenial elements and can be widely scattered along the lamella edge.

Nevertheless, these oddly shaped and frequently septate "leptocystidia" are present in the majority of the lamellae examined. Scanning 1-3 mm long whole mounts of the lamella edge facilitates the demonstration of these structures.

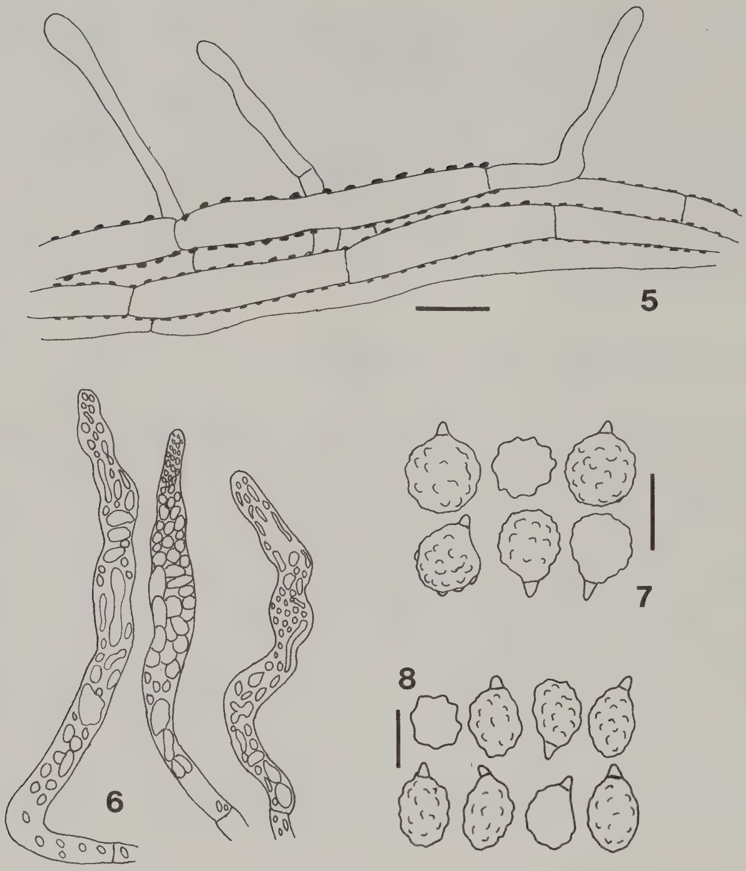
Clitopilus orientalis is an old world tropical member of Section Scyphoides with a similar distribution to *C. apalus*. In fact, *C. orientalis* was mistakenly identified as *C. apalus* at first by us and others. However, *C. apalus* has very distinctive, subglobose basidiospores (Fig. 14, 15, 22), while *C. orientalis* has ellipsoid or short ellipsoid basidiospores (Fig. 4). A description and discussion of *C. apalus* is given below. For comparisons to *C. crispus* and *C. peri* see the discussions at the end of the descriptions of those taxa as well as the key provided.

Rhodocybe perplexa **Baroni & Watling, *sp. nov.*** Figs. 5-7, 19

Pileus subrubro-brunneus, 14 mm latus, convexus, dicso papillato praeditus, glaber. Lamellae adnatae, subdistantes, latae, crassae. Stipes atro-rubrobrunneus, in apice 3 mm latus, 10 mm longus, aequus, glaber. Basidiosporae 4.7-6.4 x 4-5.5 um (Q = 1.23: E = 1.02-1.43), subglobosae vel late in aspectu et frontali et obliquo ellipsoideae, aliquot subglobosae, valde in aspectu polari angulatae, typice 8-10 paginulis praeditae, valde omnibus partibus undulato-pustulatae. Basidia 22-24 x 6.4 mm, clavata, 4-sterigmatiphora. Pleurocystidia cheilocystidiis similia, pseudocystidia 47-90 x 4.8-7.2 um, maximam partem cylindrica in apice subangustata, aliquot ventricosa, contentus atro-subrubrochraceos coagulatos continentia. Pileipellis stratum compactum subrubrochraceum formans e hyphis cylindricis repentibus 3.2-7.2 um diametro pigmenta tenuiter encrustata continentibus composita. Fibulae absentes.

Holotypus: R.Watling 25152, Malaysia, Megri Sembilan, Pasoh Forest Preserve, Pasoh Field Station (E) lectus.

Pileus dingy reddish brown, 14 mm broad, convex with a papillate disc, undulate around margin, glabrous. ***Lamellae*** deep fuscous as dried, adnate, subdistant, broad and thick. ***Stipe*** dark reddish brown, 3 mm broad at apex, 19 mm long, equal, glabrous. ***Basidiospores*** (Figs. 7, 19) color in deposit not known, 4.7-6.4 x 4-5.5 µm (n/1 = 33, L^m = 5.5 ± 0.48, W^m = 4.5 ± 0.32, E = 1.02 - 1.43, Q = 1.23), subglobose to broadly ellipsoid, or nearly globose in profile and face views, strongly angled in polar view with typically 8-10 facets, strongly undulate pustulate in all views. ***Basidia*** 22-24 x 6.4 µm, clavate, 4-sterigmate. ***Cheilocystidia*** and ***Pleurocystidia*** (pseudocystidia) (Fig. 6) similar, 47-90 x 4.8-7.2 µm, mostly cylindric with a slightly tapered apex, some slightly ventricose, often with sinuous-undulate thin walls, with dark rusty-ochre coagulated contents in 3% KOH, only slightly projecting beyond hymenium (5.6-16 µm). ***Lamella trama*** of parallel, hyaline, short inflated, barrel-like cells, 8-23 µm in diam. ***Pileipellis*** (Fig. 5) a compact reddish-ochre layer of repent, cylindric hyphae, 3.2-7.2 µm in diam, with finely but distinctly brownish encrusted pigments, this layer producing scattered, erect, cylindric, hyaline end cells. ***Context*** of radially arranged, hyaline, cylindric or short barrel-shaped,



Figs. 5-8. Figs. 5-7. *Rhodocybe perplexa* (Holotype). Fig. 5. Pileipellis. Fig. 6. Pseudocystidia. Fig. 7. Basidiospores. Fig. 8. *Rhodocybe dingleyi* (ISOTYPE, ZT 72/582), basidiospores. Horizontal scale bar = 10 μm for Figs. 5-6. Vertical scale bars = 5 μm for Figs. 7-8.

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inflated hyphae, 6-20 μm in diam, the inflated hyphae especially abundant near the hymenium. ***Clamp connections*** none.

Solitary on soil under dipterocarps on a trail. March.

Material examined: MALAYSIA. Negri Sembilan. Pasoh Forest Reserve, Pasoh Field Station, on trail side, 17 March 1992, Watling 25152 (E, HOLOTYPE).

Additional material examined: PAPUA NEW GUINEA. Morobe District, Gurakor (between Lae and Bulolo), 4 May 1972, leg. A. Kairo (ZT 72/443, HOLOTYPE of *Rhodocybe mustellina*). NEW ZEALAND. North Island. Mangatangi Gorge, Hunua Range, 26 April 1972, leg. Dingley (ZT 72/582, ISOTYPE of *Rhodocybe dingleyi*).

Rhodocybe perplexa seems most closely allied to either *R. russularia* Singer or *R. mustellina* Horak in section *Rhodocybe* because of the unusually small, nearly subglose basidiospores. However, these taxa may be separated from one another by several morphological differences. *Rhodocybe russularia* has slightly shorter basidiospores (5-5.5 μm in length) which are irregularly angular in profile view, and pseudocystidia which contain very pale yellowish amorphous contents. *Rhodocybe russularia* also is characterized by paler cinnamon or ochraceous to yellowish-tan colors of the pileus, stipe and lamellae and is only known from the Americas. *Rhodocybe perplexa* has non-angular spores in profile view, darkly pigmented pseudocystidia and distinctly darker colored pileus and stipe.

Rhodocybe mustellina, which has a brownish or brownish-orange pileus and argillaceous or pale brownish lamellae is clearly different from *R. perplexa* by its crowded lamellae, short-ellipsoid to pip-shaped basidiospores (Figs. 10-11, 20), and the less obvious, “pale yellow brown” encrustations on the hyphae of the pileipellis. Horak (1979a) compared *R. mustellina* to *R. dingleyi* Horak (Horak, 1979b) (Figs. 8, 21) and considered these two species similar in many respects. However, after an examination of the ISOTYPE of *R. dingleyi*, we were unable to find pseudocystidia in this taxon. *R. dingleyi* is better placed in section *Rubrobrunnea* of *Rhodocybe* (Baroni, 1981) and does not appear to be related to either *R. mustellina* or *R. perplexa*.

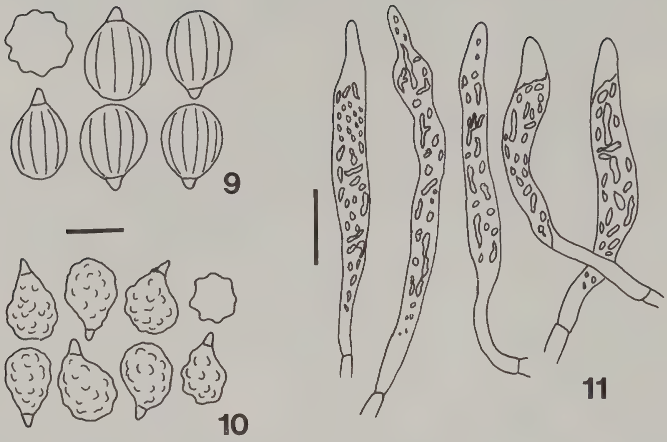
Clitopilus apalus var. macrosporus **Baroni & Watling, *var. nov.*** Fig. 9

A Clitopilo apalo var. apalo sporis majoribus differt.

Holotypus: D. N. Pegler U1528, Uganda, Provincia Occidente, Regione Bunyoro, Sylva Bundongo, Busingiro House, in solo nudo sub arbore Mangiferae, mense Junio 16, 1968 lectus (K).

Material examined: UGANDA. Western Province, Bunyoro District, Budongo Forest, Busingiro House, on bare soil under mango tree, 1189 m alt., 16 June 1968, Pelger U1528 (K, HOLOTYPE).

This new variety from Uganda differs from *C. apalus* var. *apalus* by its larger basidiospores and somewhat larger basidiomata (see discussion under *C. apalus* below). *Clitopilus apalus* var. *apalus* and var. *macrosporus* are placed in Section *Scyphoides* because of the short basidiospores which have more than six longitudinal ridges (Singer, 1986). The tropical members of Section *Scyphoides* are characterized in the key below.



Figs. 9-11. Fig. 9. *Clitopilus apalus* var. *macrosporus* (Holotype), basidiospores. Figs. 10-11. *Rhodocybe mustellina* (Holotype). Fig. 10. Basidiospores. Fig. 11. Pseudocystidia. Horizontal scale bar = 5 µm for Figs. 9-10. Vertical scale bar = 10 µm for Fig. 11.

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2. NOTES ON *CLITOPILUS* IN MALAYSIA

Two other members of the genus *Clitopilus* were collected in the Pasoh Forest Reserve. These two taxa are, *Clitopilus apalus* var. *apalus* (Berk. & Br.) Petch and *C. hobsonii* (Berk.) P. D. Orton. Brief descriptions are provided.

***Clitopilus apalus var. apalus* (Berk. & Br.) Petch,** Ann. Roy. Bot. Gard. Peradeniya 6:326. 1917. Figs. 12-15, 22

≡ *Lentinus apalus* Berk. & Br. J. Linn. Soc. 14:45. 1873.

Pileus white becoming ivory, broadly convex with shallow, broadly depressed disc or deeply umbilicate, 7-24 mm broad, margin inrolled, irregularly crenulate, often undulate and striate-rivulose or strongly veined, striae or veins extending to 1/2 radius toward disc, surface sericeous, matted fibrillose or suede-like, some caps with small strigose pointed tufts of fibrils at the ends of striae on crenulate margin, dry. ***Lamellae*** grayish but soon pale cocoa-colored or pale pinkish cinnamon, decurrent, crowded, narrow. ***Stipe*** white over apex or becoming vinaceous buff with age, more buff colored downward, white tomentose at base, 1.5-5 mm broad at apex, 10-25 mm long, more or less equal or slightly enlarged downward, central, solid within. ***Odor*** strong soapy or farinaceous. ***Taste*** farinaceous. ***Basidiospores*** (Figs. 14, 22) fleshy pink in depost, 4.5-7 x 3-5.5 µm (n/7 = 212, $L^m = 5.8 \pm 0.62$, $W^m = 4.4 \pm 0.61$, E = 1.04-1.76, $Q^m = 1.35 \pm 0.14$; HOLOTYPE: n = 37, $L^m = 5 \pm 0.29$, $W^m = 4.2 \pm 0.21$, E = 1.10-1.47, $Q = 1.20 \pm 0.07$), very short ellipsoid, some almost subglobose in profile and face views, with obvious longitudinal ridges in profile and face views, strongly angled in polar view, typically with 7-11 facets. ***Basidia*** (Fig. 13) 17-27 x 6.4-8 µm, broadly clavate, 4-sterigmate. ***Pleurocystidia*** absent. ***Cheilocystidia*** (Fig. 13) on young specimens easily found, on older specimens sometimes widely scattered and obscure or difficult to demonstrate, often inconspicuous and not projecting appreciably, 23-65 x 6.4-10 µm, cylindric or narrowly ventricose, frequently septate, with apical regions often undulate or contorted, thin-walled, hyaline. ***Lamella trama*** of parallel, cylindric, hyaline hyphae, 2.4-4.8 µm in diam. ***Pileipellis*** a hyaline layer, 100-200 µm thick, of loosely interwoven, typically ascendant, cylindric, septate hyphae, 2-6.5 µm in diam, not encrusted. ***Context*** of radially arranged, hyaline, short cylindric or barrel shaped cells, 4-12 µm in diam. ***Stipitipellis*** a hyaline layer of compact, repent, cylindric hyphae, 2.5-8 µm in diam; at apex producing scattered or clustered, erect, cylindric, broadly ventricose or versiform, septate, thin-walled, hyaline caulocystidia (Fig. 12), 20-90 x 4-8 µm. ***Stipe context*** composed mainly of hyaline, parallel rows of thin-walled, barrel shaped cells, 20-65 x 10-24 µm. ***Clamp connections*** absent.

Scattered or gregarious on soil, in or along trails. March.

Material examined: MALAYSIA. Selangor. Kepong, Forest Research Institute Malaysia, mid track of truck rut on Rover's Trail, 24 March 1995, Watling 26394 (E,); same locality, on muddy soil on side of track, Rover's Trail, 24 March 1995, Watling 26393 (E); same locality, on side of trail, Rover's Trail, 20 March 1995, Watling 26396 (E); same locality, on trail, behind mosque, 27 March 1995, Watling 26395 (E); same locality on trail under *Dipterocarpus*,27 March 1993, Watling 76 (E). Negri Sembilan. Pasoh Forest Reserve, on soil by trail, 17 March 1992, Watling 25153 (E) and in same locality, on trail near Forest Research Institute Field Station, in rainforest, 17 March 1992, Watling 24543 (E).
Additional material examined: SRI LANKA. Peradeniya. 2 August 1869, Thwaites 725 (K, HOLOTYPE).

This report is the first of *Clitopilus apalus* from Malaysia. This species appears to be widespread in the old world tropics, having been reported from the eastern regions of Africa (Pegler, 1977a) and from Sri Lanka (Berkeley and Broome, 1873). Although *C. apalus* is typically found growing on soil and leaf litter, Pegler (1977a) noted that it also can be found on ant hills and termite mounds in Uganda. We have not found collections of *C. apalus* on termite mounds or ant hills as yet in Malaysia, but we have collected *C. orientalis* and *C. hobsonii* from termite mounds. Old termite mounds, at least in the neotropics, appear to be a good substrate for many different species of saprotrophic agarics (Baroni, unpublished).

Our specimens of *C. apalus* are distinctly smaller than the sizes indicated by Pegler (1977a), who reported the pileus as 20-70 mm broad in his collections from Uganda. However, in the protologue, the pileus dimensions of *C. apalus* from Sri Lanka were described as 1 inch across (Berkeley and Broome, 1873). Thus, our collections from Malaysia more nearly match those of the type in the size of the basidiomata and the basidiospores. The basidiospores of the collection from Uganda (Pegler U1528) are significantly larger than is typical for *C. apalus* ($P = < 0.05$ for a rank sum test of a comparison of the means of the length, width and Q values). Basidiospores from the Uganda collection measure 6-7 x 4.8-6.4 μm (n = 31, mean = 6.7 x 5.5 μm, Q = 1.21), while the mean dimensions for typical *C. apalus* basidiospores are clearly smaller, mean = 5.8 x 4.4 μm. The other features of the Uganda collection, besides basidiospore size, size of basidiomata and ecological preference, match *C. apalus* rather well. We therefore proposed the new variety, *C. apalus* var. *macrosporus*, described above in the section titled New Taxa.

***Clitopilus hobsonii* (Berk.) P. D. Orton,** Trans. Brit. Mycol. Soc. 43:174. 1960.
≡ *Agaricus hobsonii* Berk., Outlines of British Fungi. 138. 1860.

A single collection of two white pleurotoid basidiomata of this species was found fruiting from termite mounds. A modern description of the macroscopic features of this species can be found in Orton (1960). The microscopic characters of these specimens are as follows:

Basidiospores 6.7-9.3 x 4.2-5.7 μm (n = 30, $L^m = 8.09 \pm 0.58$, $W^m = 5.05 \pm 0.35$, E = 1.47-1.88, Q = 1.60), broadly ellipsoid in profile and face view, obscurely ornamented with longitudinal ridges (stain basidiospores with cotton blue or use interference optics), minutely or obscurely angled in polar view with 9-11 facets. ***Basidia*** 19-22 x 8 μm, broadly clavate, 4-sterigmate. ***Cheilocystidia*** and ***pleurocystidia*** absent. ***Lamella trama*** of parallel, cylindric or inflated hyphae, 4-10.5 μm in diam. ***Pileipellis*** a hyaline layer, 80-120μm thick, of loosely interwoven, mostly erect, often septate, cylindric end cells, 2.4-6.5 μm in diam. ***Context*** of radially arranged, hyaline, cylindric hyphae, 4-10 μm in diam.

Material examined: MALAYSIA. Negri Sembilan. Pasoh Forest Reserve, on the side of a termite mound on the Nature Trail, 13 March 1995, Watling 26392 (E).

Although originally described from the British Isles where it is widespread yet generally overlooked, *Clitopilus hobsonii* seems to enjoy a world-wide distribution and can be found in a variety of habitats (Singer, 1978).

3. Extralimital taxa that likely occur in Malaysia

***Clitopilus crispus* Pat.**, Bull. Soc. Mycol. France 29:214. 1913. Fig. 16, 23

This species has not been reported in the literature since it was first described from the La Pho, Tonkin area of Vietnam by Patouillard. The holotype consists of four, more or less, whole basidiomata. The tissues do not revive well, however, the following information on anatomical characters was obtained. The macroscopic description is taken directly from the protologue and is therefore placed in quotes.

"Solitaire or groupé. Chapeau d'abord convexe, puis plan et enfin déprimé, blanc, plus ou moins bistré vers le centre, charnu, 3-5 cent. de diam., à bords déchirés ou crispés. Stipe plein, charnu, droit ou courbé, cylindrique, égal, concolore au chapeau, 3-5 ent. de long, 4-6 millim. d'épaisseur. Lames décurrentes, serrées, inégales, rosées. Spores carnées roussâtres en tas, incolores au microscope, ovoïdes et apiculées à la base, quand on les observe à plat, hexogonales vues par un des bouts, marquées de côtes longitudinales très peu saillantes, 6 x 4 μ.

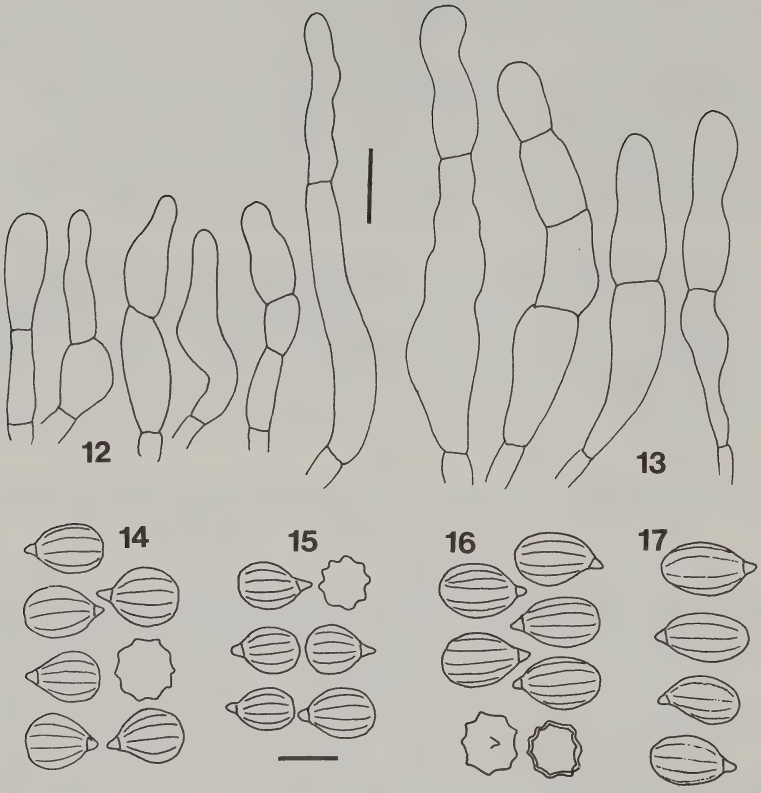
Ressemble à *C. orcella* Fr., en différe par ses bords constamment lacérés-crispés et par ses spores plus petites et moins colorées."

Basidiospores (Figs. 16, 23) 6.2-7.6 x 4-5.3 μm (n = 35 , $L^m = 6.83 \pm 0.39$, $W^m = 4.67 \pm 0.27$, E = 1.32-1.61, Q = 1.46), ellipsoid in profile and face view, angled in polar view with 9-12 facets, longidutinal ridges obvious in all views. ***Basidia*** 15.5-23 x 6.4-8 μm, clavate, 4-sterigmate. ***Cheilocystidia*** not seen. ***Pileipellis*** not reviving well, apparently repent in radial section, hyaline, hyphae appear to be cylindric, 3-5 μm in diam. ***Clamp connections*** absent.

Material examined: VIETNAM. Tonkin. La Pho. "sur la terre en forêt", 19 May 1909, M. Demange 342 (FH, HOLOTYPE).

Clitopilus crispus is one of the larger members of the section *Scyphoides* with its pileus reaching 50 mm broad. The brownish colored pileus disc and the basidiospores size, with a Q of 1.46, also are diagnostic features for this species. *Clitopilus peri* is somewhat similar, but the pileus is typically only 25 mm broad, and it becomes umbilicate or infundibuliform with age. The Q value of the basidiospores for *C. peri* is 1.57, somewhat larger than the Q value of 1.46 for *C. crispus*.

Clitopilus apalus and *C. orientalis* also are readily distinuished from *C. crispus* due to their basidiospore morphology and/or the Q value of the basidisopores. For features which are used to distinguish these taxa, please refer to the key below. In particular, when a statistical comparison of the length, width and Q values of the basidiospores of the type collection of *C. crispus* (n = 35) is made to numerous specimens of *C. orientalis* (n = 149), significant differences (P = < 0.05) for each of these basidiospore attributes are revealed. *Clitopilus crispus* also lacks cheilocystidia as indicated by Patouillard (1913) and confirmed by our study of the type collection. *Clitopilus orientalis* produces widely scattered cheilocystidia.



Figs. 12-17. Figs. 12-14. *Clitopilus apalus* var. *apalus* (Watling 26394). Fig. 12. Caulocystidia. Fig. 13. Cheilocystidia and basidium. Fig. 14. Basidiospores. Fig. 15. *Clitopilus apalus* var. *apalus* (Holotype), basidiospores. Fig. 16. *Clitopilus crispus* (Holotype), basidiospores. Fig. 17. *Clitopilus peri* (Holotype), basidiospores. Vertical scale bar = 10 μm for Figs. 12-13. Horizontal scale bar = 5 μm for Figs. 14-17.

***Clitopilus peri* (Berk. & Br.) Petch,** Ann. Roy. Bot. Gard. Peradeniya 6:316. 1917. Figs. 17

≡ *Agaricus peri* Berk. & Br. J. Linn. Soc., Bot. 11:527. 1871.
≡ *Omphalia peri* (Beri. & Br.) Sacc. Syll. Fung. 5:311. 1887.
= *Clitopilus orcelloides* Pat. & Demange Bull. Soc. Mycol. France 10:40. 1910.

Pegler (1977a & 1977b) reports an additional collection of this species from Sri Lanka and another single collection from Uganda in eastern Africa. *C. peri* was originally collected by Thwaites and reported from Sri Lanka by Berkeley and Broome (1871). The following description (in quotes) is taken directly from the more recent collections made by Pegler.

"***Pileus*** 8-22 mm diam, membranous, at first convex soon umbilicate; surface pure white, dry, glabrous, non-striate; margin at first incurved, undulating. ***Lamellae*** adnato-decurrent, white then pinkish, up to 1.5 mm wide, moderately spaced, with one series of lamellules (sic). ***Stipe*** 1-2 cm x 1-2 mm, equal filiform, solid; surface white, glabrous. ***Context*** very thin, with thin-walled, hyaline hyphae, 1.5-6 μm diam., lacking clamp-connexions. ***Spores*** 6.7-8.5 x 3-4 (7.5 ± 0.51 x 3.5 ± 0.27) μm; Q = 2.14, ellipsoid, adaxially applanate, with 6-9 weakly raised ridges; wall thin, hyaline. ***Basidia*** 16-18 x 5-7 μm, broadly clavate, bearing four sterigmata. ***Lamella-edge*** fertile. ***Hymenophoral trama*** regular, hyaline, with thin-walled hyphae, 2-5 μm in diam. ***Subhymenial layer*** 4-8 μm wide, poorly developed. ***Pileal surface*** repent epicutis of loosely arranged hyphae, 2-3 μm in diam."

Gregarious in small groups on soil and rotting leaves in forests. June-July, and November.

A study of the type yielded the following information on its microscopic features. In general, it was difficult to revive the tissues for a complete study of these features, even when sections were gently heated and then soaked overnight the cells remained collapsed.

Basidiospores 6-8 x 3.8-5 μm (n = 22, L^m = 7 ± 0.54, W^m = 4.46 ± 0.32, E = 1.49-1.73, Q = 1.57), ellipsoid in profile and face view, with obscure longitudinal ridges, distinctly but not strongly angled in polar view, with 6-8 facets, the low ridges making facets weakly developed. ***Basidia*** mostly collapsed, but obviously 4-sterigmate. ***Hymenial cystidia*** absent. ***Pileipellis*** a repent layer of hyaline, cylindric hyphae, 1.6-4.8 μm in diam, not encrusted. ***Context*** not reviving well. ***Clamp connections*** absent.

Material examined: SRI LANKA. 10 July 1869, Thwaites 1192 (K, HOLOTYPE). UGANDA. Buganda Province, Mengo District, Mpanga Research Forest, 1250 m alt., 11 June 1968, D. N. Pegler 1402 (K).

Clitopilus peri is a small, delicate, omphalinoid, tropical species which is morphologically similar to the temperate western hemisphere *C. scyphoides* (Fr.) Singer. These two taxa may or may not be conspecific, however, their respective ecological differences suggest that they should not be placed in synonymy at this time. Certainly, based solely on morphological characters, it is difficult to differentiate them clearly. Although, Pegler (1977) suggests that *C. peri* differs from *C. scyphoides* because of the snow white colors of the basidiomata for *C. peri* in the fresh and dried condition. *Clitopilus scyphoides* is white, but apparently the hues are duller or dingier.

Clitopilus orcelloides, which was reported from a tropical habitat similar to that of *C. peri,* is morphologically indistinguishable from *C. peri* and is here considered a synonym. *Clitopilus orientalis* is somewhat similar in color and shape, but *C. orientalis* differs by the more robust basidiomata and the presence of cheilocystidia.

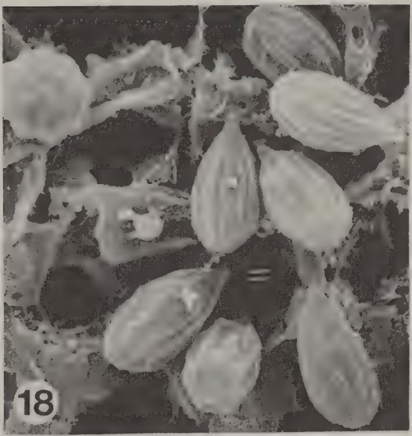
KEY TO THE SPECIES OF *CLITOPILUS* FOUND IN OR AROUND MALAYSIA

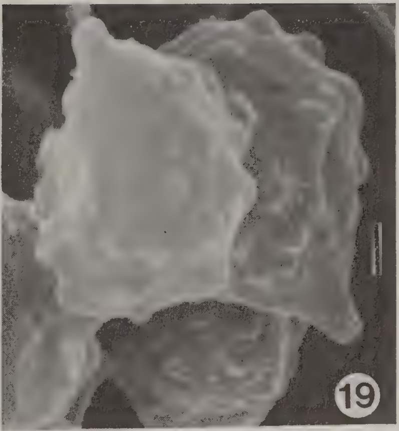
1. Basidiomata pleurotoid, on decaying or living plant material, soil, or termite mounds; basidiospores 6.5-9 x 4-5.7 μm .... **C. hobsonii**
1. Basidiomata centrally stipitate 2
    2. Basidiospores short ellipsoid or nearly subglobose, with distinct longitudinal ridges, Q < 1.40 3
    2. Basidiospores ellipsoid, not tending towards subglobose shapes, longitudinal ridges distinct or not, Q > 1.40 4
3. Basidiospores 4.5-7 x 3-5.5 μm (mean = 5.8 x 4.4 μm) .... **C. apalus var. apalus**
3. Basidiospores 6-7(-8) x 4.8-6.4 μm (mean = 6.8 x 5.5 μm) .... **C. apalus var. macrosporus**
    4. Pileus moderately large, reaching 40 mm broad, white; Q of basidiospores = 1.65; cheilocystidia usually present, scattered, hyaline, septate... **C. orientalis**
    4. Pileus typically less than 25 mm broad, if larger then disc brownish; Q of basidiospores< 1.65; cheilocystidia absent 5
5. Pileus up to 50 mm broad, convex then plane, eventually slightly depressed, margin distinctly lacerate-crisped, surface white with a brownish disc; pileus context thick; cheilocystidia absent; Q of basidiospores = 1.46 .... **C. crispus**
5. Pileus less than 25 mm broad, convex at first, soon umbilicate or infundibuliform, snow white at all times, margin smooth, not lacerate or crisped; pileus context very thin; Q of basidiospores = 1.57 or more .... **C. peri**

ACKNOWLEDGMENTS

The following curators kindly arranged loans for study, Drs. Roy E. Halling (NY), Egon Horak (ZT), David N. Pelger (K), and Donald H. Pfister (FH). RW wishes to thank the Director and staff of the Forest Research Institute Malaysia, Kepong. Special recognition is due Dr. Lee Su See, for help and support in the field and laboratory.

Figs. 18-23. Scanning electron micrographs of basidiospores. Fig. 18. *Clitopilus orientalis* (Watling 25156). Fig. 19. *Rhodocybe perplexa* (Holotype). Fig. 20. *Rhodocybe mustellina* (Holotype). Fig. 21. *Rhodocybe dingleyi* (Isotype). Fig. 22. *Clitopilus apalus* (Watling 76). Fig. 23. *Clitopilus crispus* (Holotype). All scale bars = 1 μm.


18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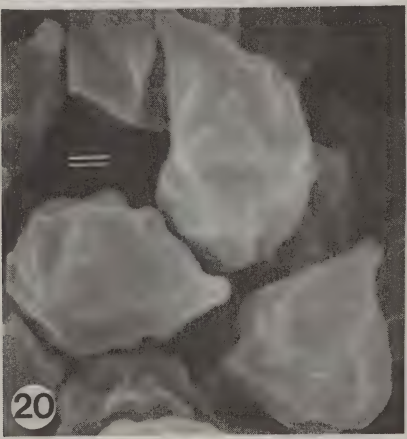
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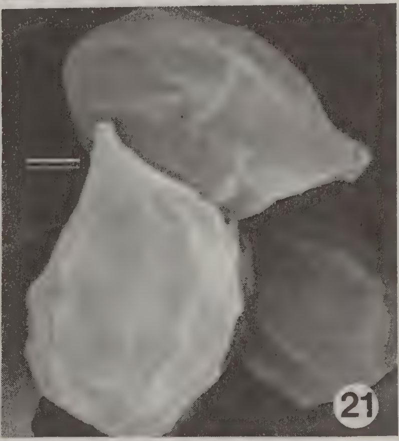
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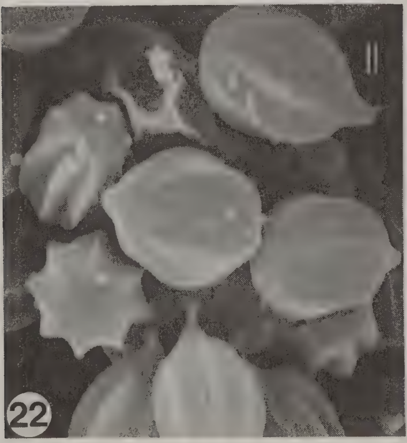
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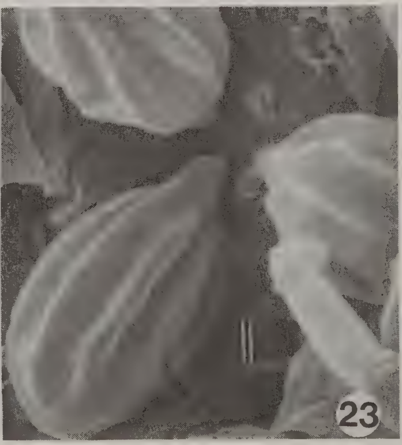
23

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MYCOTAXON

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LECIDELLA AEGAEA SP. NOV. (LECANORACEAE, LECANORALES, LICHENIZED ASCOMYCOTINA)

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Abstract: A description is presented for *Lecidella aegaea* Knoph & Sipman sp. n. It is only known so far from the Aegean Islands (Greece, East Mediterranean Sea).

Introduction

The crustaceous genus *Lecidella* is widespread from (ant)arctic to tropical zones and comprises about 40 species. The vast majority usually inhabits exposed siliceous rock and/or bark. There are several recent papers dealing with the saxicolous taxa (e. g. Hertel, 1977; Poelt & Vězda, 1981; Rambold, 1989; Knoph, 1990; Leuckert et al., 1990, 1992; Knoph & Leuckert, 1994; Knoph et al., 1995a, 1995b) and a few more recent publications on the non-saxicolous taxa (e. g. Poelt & Vězda, 1981; Tønsberg, 1992; Knoph et al., 1995b; Knoph & Leuckert, 1997). During the revision of saxicolous specimens of the genus, a new species was discovered from the Aegean Islands (Greece, East Mediterranean Sea), for which a description is presented.

Materials and Methods

The specimens analyzed (analysis-number follows the herbar-acronym) for this study were deposited in the herbarium B (Botanischer Garten und Botanisches Museum Berlin-Dahlem, Freie Universität Berlin). The chemistry was examined by means of thin-layer chromatography (TLC) using the standardized methods of Culberson (1972). Chloroxanthones were detected with a method developed by Leuckert & Knoph (1992). In addition, one sample (leg. Sipman no. 29139 & Raus) was studied using lichen mass spectrometry as described in Leuckert et al. (1990). Morphological and anatomical characters were examined with Zeiss binocular microscopes (6,5-50 x, and 32x, 63x, 125x, 250x, 500x, 1000x). Apothecial anatomy was studied in 10-15 µm thick vertical sections (Leitz freezing microtome) mounted in water or in lactophenol and stained with cotton blue. Tests for amyloid reactions were usually made by mounting sections directly in Lugol's solution (I_{conc}).

Lecidella aegaea Knoph & Sipman spec. nova

Diagnosis: Thallus crustaceus, ca. 0.5 (1.2) mm crassus, usque ad 5 cm in diametro, albidus aut alboflavescens, areolatus vel rimosoareolatus, sorediis et isidiis destitutus. Apothecia frequentia, dispersa, 0.5 - 0.8 mm (max. 1.6 mm) in diametro, sessilia vel semiimmersa, margine atro, distincto, disco plano vel convexo, atro, epruinoso. Epihymenium ca. 10 µm altum, coeruleoviridi vel viridiatrum. Hymenium incoloratum, 55 - 75 µm altum. Subhymenium incoloratum. Hypothecium incoloratum vel (fusco)flavescens, ca. 240 µm altum. Excipulum 35 - 90 µm latum, interne fuscescens. Paraphyses ca. 2.5 µm, apice ad 5.0 µm in diametro. Asci clavati, ca. 55 x 25 µm. Sporae ellipsoideae, unicellulares, non halonatae, 12 - 15 µm longae, 6.5 - 8 µm latae.

Type: GREECE, Cyclades Archipelago, Antiparos. Hagios Georgios, cap Trachilos. Co-ord. 36°59' N, 25°01' E; alt. c. 10 m, schistose rock with patches of halophilous vegetation at the coast. 16 June 1998, H. Sipman 42881 & T. Raus (B, Holotype, 4039)

Description: Thallus areolate to rimose-areolate, up to 5 cm diameter, up to c. 1.2 mm thick, whitish to pale yellowish grey, with more or less rough surface. Algal cells ca. 8 - 13 (- 16) µm diameter. Medulla I-, hyphae c. 4.5 - 5.5 µm thick. Hypothallus rarely developed (between two adjacent thalli), black, up to 0.25 mm thick. Apothecia round, rarely irregular, dispersed to rarely dense, partly subimmersed into the thallus or sessile, more or less constricted at the base, c. 0.5 - 0.8 (- 1.6) mm diameter. Disc plane or convex, slightly nitid, epruinose. Margin distinct from the beginning, black, slightly nitid. Excipulum aside of hymenium 35 - 70 (- 90) µm thick, widely extended below the hypothecium in older apothecia. Ectal zone c. 10 µm thick, greenish to blackish brown, hyphae c. 3 - 5 µm diameter, with lumina of c. 1 µm. Inner zone brown, hyphae c. 3 (- 4) µm diameter, with lumina of c. 1 µm. Medullary zone not obvious. Hypothecium colorless in upper part and usually yellowish brown below, up to 250 (- 320) µm thick, hyphae c. 3 (- 5) µm diameter, subhymenial layer colorless, hymenium c. 55 - 75 µm thick, colorless, sometimes inspersed below (pro parte by crystals), I± blue, I_{conc}-. Epihymenium bluish to blackish green, c. 10 µm thick. Paraphyses rarely branched and anastomosing, c. 2.5 µm, apical cells up to c. 5 µm diameter. Asci c. 55 x 25 µm. Tholus max. c. 8 µm thick, outer amyloid wall layer c. 1.0 (- 1.5) µm, non-amyloid wall layer c. 0.5 (- 1.0) µm thick. Spores ellipsoid, 12 - 15 x 6.5 - 8 µm. Pycnidia immersed. Conidia filiform, curved, c. 18 - 32 x 1 µm.

Chemistry: One chemotype observed, containing aotearone, 2,5,7-trichloro-3-*O*-methylnorlichexanthone (major compounds); 3-*O*-methylasemone, isoarthothelin, thiophanic acid (traces) (12 specimens examined).

Ecology and distribution: *Lecidella aegaea* is only known so far from the island groups of Santorini and Paros in the Aegean Sea, Greece (islands Thira, Thirasia, Palea Kaimeni, Antiparos, Paros). It appears to be rather frequent on slanting faces of low outcrops of siliceous, not very acid, metamorphic or volcanic rock in phrygana dwarf shrub vegetation, at elevations of c. 10 - 100 (- 250) m. The lichen vegetation of these outcrops is often dominated by xanthone-containing, crustose lichens, especially *Lecidella asema* (Nyl.) Knoph & Hertel and *Lecanora rupicola* (L.) Zahlbr. ssp. *sulphurata* (Ach.) Leuckert & Poelt. The localities are never more than a few km from the coast, and thus probably have considerable influence from salt spray. In contrast, the closely related *Lecidella asema* has a much wider ecological range and extends to the highest elevations of the islands, at 700 m on Mt. Agioi Pantes, Paros. *Lecidella aegaea* is probably more widespread on the Cyclades and elsewhere in the Mediterranean, and is often erroneously assumed to be an aged, bleached form of the somewhat more intensely yellow *Lecidella asema*.

Discussion: *Lecidella aegaea* is characterized by broad, usually sessile apothecia, a colorless (in the lower part) to often yellowish hypothecium, a well developed heavily pigmented excipulum, and the presence of several xanthones including aotearone and 2,5,7-trichloro-3-*O*-methylnorlichexanthone as major compounds. The excipulum extended widely below the hypothecium in older apothecia and is unique within the genus *Lecidella* and reminiscent of some species of the genus *Carbonea*. *Lecidella effugiens*, which shows a similar chemistry, can be distinguished by a usually browner hypothecium, smaller apothecia and a thinner thallus. *Lecidella chodatii* can be differentiated by smaller apothecia, a colorless hypothecium, a usually granulose and thinner thallus and a different chemistry (Chodatin and/or Demethylchodatin along with several xanthones). *Lecidella asema* usually has a browner hypothecium and often a less pigmented excipulum and several differences concerning the various chemotypes.

Additional specimens examined:
GREECE, Cyclades Archipelago (Nomos Kikladhon):
Santorini archipelago: Palea Kaimeni island, 25°23.5'E, 36°23.5'N, young K3-lava on NE-side, c. 10 m, 20.V.1990, H. Sipman 28834 & Th. Raus (B; 3010). - dto., on rock outcrops of the top plateau, c. 100 m, 20.V.1990, H. Sipman 28904 & Th. Raus (B; 3012). - Thirasia island, 25°22'E, 36°25.5'N, on walls among fields S of Manolas, c. 150 m, 22.V.1990, H. Sipman 29011 & Th. Raus (B; 3013). - Thirasia island, 25°22'E, 36°25.5'N, along trail from Corfos harbour to Manolas, E-facing steep rocky (lava) slope with scarce vegetation, c. 100 m, 22.V.1990, H. Sipman 28963 & Th. Raus (B; 4036). - Thirasia island, 25°22'E, 36°25.5'N, on lava boulders on saddle with scarce low vegetation, between Mt. Viglos and Kera chapel, c. 250 m, 22.V.1990, H. Sipman 29034 & Th. Raus (B; 4037). - Thira island, 25°22'E, 36°25.5'N, Mt. Megalo Vouno, N-slope, c. 200 m, 24.V.1990, H. Sipman 29139 & Th. Raus (B; 3015). - dto., Cape Akrotiri, N-slope, c. 50 m, 26.V.1990, H. Sipman 29261 & Th. Raus (B; 3018). -
Antiparos: c. 1 km SE of Hagios Georgios, 36°58'N, 25°02.5'E, c. 50 m, volcanic rock outcrops at the coast on W-facing slope with low scrub, 16 June 1998, H. Sipman 42912 & T. Raus (B; 4040). - S-point of the island, cap Kavos Skilos, near Faneromeni chapel, 36°56.5'N, 25°04.5'E, 5 m, weathered volcanic rock outcrops on low, largely barren coastal hill, 19 June 1998, H. Sipman 43120a & T. Raus (B; 4041). -
Paros: E-flank of Mt. Agios Antonios, near Marpissa, 37°03'N, 25°16'E, 80 m, volcanic rock outcrops in low scrub on exposed ridge at the coast, 14 June 1998, H. Sipman 42721 & T. Raus (B; 4038). - Hill Gorakas, c. 4 km NE of Paros-town, 37°07.5'N, 25°11.5' E, c. 150-200 m, schistose rock outcrops on W- and S-facing slopes and ridge of coastal hill with low scrub, 21 June 1998, H. Sipman 43222 & T. Raus (B; 4042). -

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BACIDIA PARATHALASSICA (BACIDIACEAE, LECANORALES), A NEW MEDITERRANEAN CORTICOLOUS LICHEN

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Abstract

Bacidia parathalassica, a new corticolous lichen species, is described from the mediterranean littoral. It differs from *B. fraxinea* and *B. rubella*, by its thallus morphology, the exciple cells and the presence of crystals in exciple and epihymenium that dissolve in HNO_3.

Key words: New taxa, Lichenes, Corticolous, Mediterranean region.

Introduction

As part of the project "Lichen Flora of Iberian Peninsula", one of us (E. Ll.) is revising the genus *Bacidia* De Not. During his study he has found that some epiphytic samples from coastal areas, which were assigned to *B. rubella* (Hoffm.) A. Massal. or to *B. rosella* (Pers.) De Not., show significant differences from these taxa, and also from *B. fraxinea* Lönnr., a taxon that has been recently reinstated (EKMAN & NORDIN 1993).

Because of the morphological characteristics that make these samples significantly different from hitherto described species, a new species is proposed to accomodate them, namely *Bacidia parathalassica*.

Material and Methods

The collections studied were provided by the following herbaria: BC, BCC, BIO, C, GZU, H, L, LD, MA, MAF, UPS, VAB and VIT.

The specimens were examined with a binocular dissecting microscope (Olympus SZH10) and a microscope Leitz Diaplan with DIC (differential interference contrast) optical systems. The anatomy of apothecia and thalli and spot test reactions were studied in hand-cut sections mounted in water. The ascospore measurements are given as in EKMAN & NORDIN 1993, and the standard deviation (s), the number of specimens studied (N) and the number of measurements per specimen are given for each species. The photomicrographs of the excipulum were made after pretreatment with HNO_3, solution of 35%, then with KOH (K) solution of 10%, and mounted in water. Some samples were studied by TLC according to ELIX & ERNST-RUSSEL 1993. The spore length, width and number of septa, of each species have been studied using two statistical methods, one way analysis of variance (one-way ANOVA) and Kruskal-Wallis test. All the calculations were performed with the SPSS statistical package.

Results

Bacidia parathalassica Llop & Gómez-Bolea, sp. nov. (Figs. 3-5)

Thallus crustaceus, verruculosus vel squamulosus, cinereo-viridis; stratum corticale paraplectenchymaticum, crystallis minutis K dissolventibus inspersum; stratum algarum continuum; phycobiontes subglobosi, chlorococcoidei, 6-12(-15) µm diametro. Apothecia biatorina, copiosa, aurantiaca flavida vel rubescentia, demum fuscantia, (0.3-) 0.4-1.0(-1.2) mm diametro, disco primum plano marginisque prominentis pruinoso, ad maturitatem convexo marginisque exclusis. Excipulum proprium prosoplectenchymaticum, cellulis terminalibus oblongis 4-10 x *2.5-4 µm, et crystallis minutis, aurantiacis flavidis, HNO_3 dissolventibus instructum. Epihymenium hyalinum, 3-7 µm altum, crystallis minutis HNO_3 dissolventibus vestitum. Hymenium hyalinum 60-70(-75) µm altum. Hypothecium hyalinum vel stramineum, cum K auget colore. Paraphyses conglutinatae, simplicem raro superne bifurcatae, non anastomosantes, 1 µm crassae, ad apicem incrassatae, leviter capitatae, usque ad 2.5-3 µm lates. Asci clavati, 40-60(-70)* x *7-12 µm, Bacidiae typo. Ascosporae hyalinae, rectae, aciculares, leviter asymmetrae, cum (3-) 5-7(-9) septis, (26-)33.6-41.8-52.2(-59)* x *(1.5-)2.1-2.5-2.9(-3) µm. Pycnidia immersa, infuscata. Conidia filiformia, curvata, non septata, (9.6-)10.4-21.2* x *0.5-0.8 µm.*

Materia chemica: Thallus K+ flavescens infuscatus, KC-, C-, P-; atranorinam continens.

Typus: Spain, Almería province, Punta Sabinar, near Roquetas, on *Juniperus phoenicea* subs. *phoenicea*, c. 5 m (U.T.M.: 30SWF2659-2660), 20.VIII.1998, *A. Gómez-Bolea*, (BCC-Lich. 13277 holotypus; E, GZU, H)

Thallus crustose, warted to squamulose, greyish green, without hypothalline structure; algae chlorococcales, 6-12(-15) µm. Cortex paraplectenchymatous, inspersed with minute crystals dissolving in K but not in HNO_3. *Apothecia* numerous, yellowish orange to reddish, darker when ageing, (0.3-)0.4-1.0(-1.2) mm; margin raised, white-pruinose in young apothecia; disc flat to slightly convex; usually clusters of young apothecia are visibly proliferating from old ones. *Excipulum propium* prosoplectenchymatous with terminal cells oblong, 4-10 x 2.5-4 µm, and abundant crystals that dissolve in HNO_3 but not in K. *Epihymenium* 3-7 µm tall, containing numerous minute colourless crystals that dissolve in HNO_3 but not in K. *Hymenium* 60-70(-75) µm tall, colourless. *Hypothecium* colourless to straw or pale yellowish, K ± intensifying yellow. *Paraphyses* agglutinated, 1 µm wide, simple or few forked above, not anastomosed, apices slightly swollen to 2.5-3 µm in width. *Asci* clavate, 8-spored, *Bacidia*-type (HAFELLNER 1984), 40-60(-70) x 7-12 µm. *Ascospores* hyaline, straight, acicular, (3-)5-7(-9) transversely septa, (26-)33.6-41.8-52.2(-59) x (1.5-)2.1-2.5-2.9(-3) µm. *Pycnidia* immersed, yellowish brown, unilocular to plurilocular, 125-250 µm diam. *Conidia* filiform, curved, non-septate, (9.6-)10.4-21.2 x 0.5-0.8 µm.

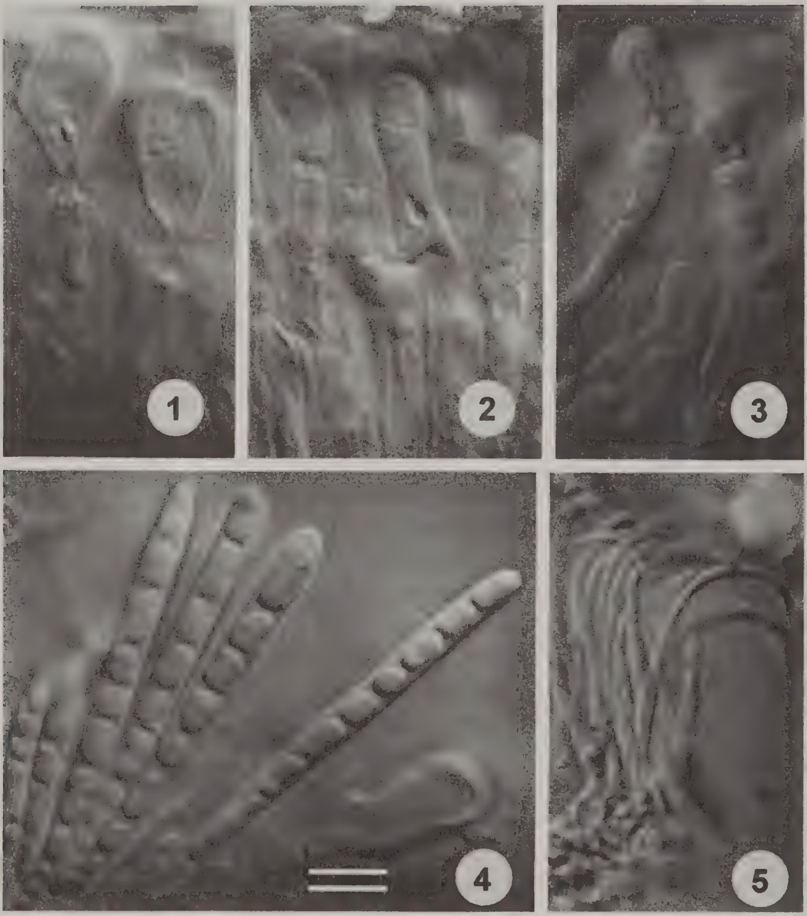
Chemistry: Thallus: K+ yellow brownish, KC-, C-, P-. TLC: atranorin.

Etymology: From Greek, *para* meaning near and *thalassos* meaning sea, because the samples come from coastal localities.

Habitat and distribution: *Bacidia parathalassica* is found on bark of *Quercus ilex* L., *Q. suber* L., *Juniperus phoenicea* L. ssp. *phoenicea*, *Olea europaea* L., *Phillyrea angustifolia* L., *Rhamnus alaternus* L., *Ficus carica* L., *Ceratonia siliqua* L., *Cupressus sempervirens* L. and *Populus alba* L. The best development is achieved on *Juniperus phoenicea* and *Quercus ilex* where it usually gives a great cover. On the former the species grows with taxa of the *Dirinetum ceratoniae* Klement subass. *thelopsidetosum isiacae* Giralt et Gómez-Bolea (GIRALT & GÓMEZ-BOLEA 1987) such as *Diploicia canescens* (Dicks.) A. Massal., *Dirina ceratoniae* (Ach.) Fr., *Bactrospora patellarioides* (Nyl.) Almq., *Opegrapha varia* Pers. and *Thelopsis isiaca* Stizenb., on the latter it shares the habitat with *Waynea stoechadiana* (Abassi Maaf & Cl. Roux) Cl. Roux & P. Clerc, *Bacidina phacodes* (Körb.) Vězda, *Gyalecta truncigena* (Ach.) Hepp, *Acrocordia gemmata* (Ach.) A. Massal. as the most frequent taxa.

Bacidia parathalassica occurs in small coastal woods or maquis belonging to the *Juniperetum eumediterraneae* (Mol.) O. Bolòs (BOLÒS 1996) community or substitutive communities.

According to the material presently available, *B. parathalassica* is confined to coastal mediterranean regions of Spain, Greece and Morocco. (Fig. 6).



Figures 1, 2 and 3: marginal cells of the excipulum of *Bacidia fraxinea* (1), *B. rubella* (2) and *B. parathalassica* (3). Figure 4: spores and figure 5: conidia of *B. parathalassica*. (bar=5 µm).

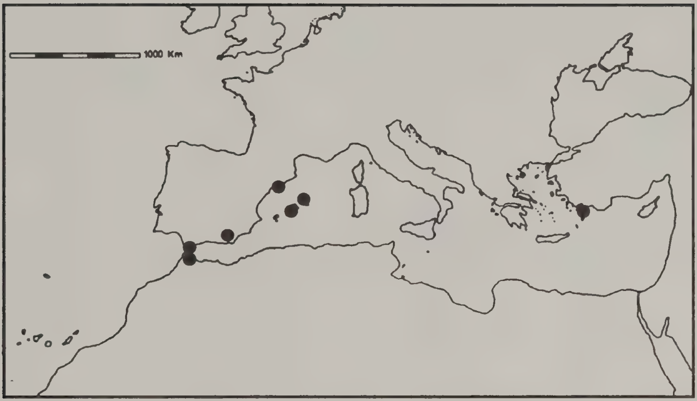


Fig. 6. Known distribution of *Bacidia parathalassica*.

Discussion

According to several authors (EKMAN 1996, WIRTH 1995, SÉRUSIAUX 1993 and CLAUZADE & ROUX 1985, 1987, 1989) the apothecial structure, and spore and conidia morphology, mainly, place the new species in the genus *Bacidia s. str.* Within this genus, *B. parathalassica* is close to *B. fraxinea* and *B. rubella*, with which it can be easily confused. The most significant differences are listed in Table I.

Morphological characteristics that were used to distinguish *B. rubella* from *B. fraxinea* (EKMAN & NORDIN 1993) also discriminate the new species from them: *B. parathalassica* has a warted to squamulose thallus compared to the continuous thallus of *B. fraxinea* and the granular and coralloid one of *B. rubella*. Microscopically, both, *B. parathalassica* and *B. rubella,* have colourless crystals in the cortex that dissolve in K, these crystals are not found in *B. fraxinea*. The three species have crystals in the exciple. Whereas in *B. parathalassica* and *B. fraxinea* they dissolve in HNO_3, and in the latter they are found occasionally, in *B. rubella* they are also occasional but they dissolve in K. Among the three species, only the new species has crystals in the epihymenium, crystals that are minute and dissolve in HNO_3 but not in K. The taxa also differ in the marginal cells of the exciple, the terminals cells are oblong in the new species and globular in *B. fraxinea* and *B. rubella* (Figs. 1 and 2).

The statistical analysis of the three species shows significant differences in the spore characters that have been considered. It is obvious that the spores of *B. parathalassica* are the smaller ones among the three species. In fact, spore length and number of septa are characters that shows a clear difference between the species and this difference is significant in both employed methods (ANOVA and Kruskal-Wallis test). The spore width presents a dubious result, it has not significant differences between the species with one-way ANOVA, whereas it had differences with the Kruskal-Wallis test. We can conclude that the three species differ in the spore characters, basically in length and number of septa.

	B. parathalassica	*B. fraxinea*	*B. rubella*
Thallus	warted to squamulose	continuous to cracked	granular, isidioid to coralloid
Cortex crystals	colourless, K + HNO_3 –	absent	colourless, K + HNO_3 –
Excipulum crystals	always present, K – HNO_3 +	occasional, K – HNO_3 +	occasional, K + HNO_3 –
Excipulum Terminals Cells	oblong, 4-10 x 2.5-4 µm	swollen, -6 µm	swollen, -5 µm
Epihymenium crystals	minute crystals HNO_3 + K –	absent	absent
Spores (observed values)	(26-)33.6-*41.8*-52.2 (-59) µm long (s= 5.79, N= 33, n= 15), (1.5-)2.1-*2.5*-2.9(-3) µm wide (s= 0.298, N= 33, n= 15)	(31-)46.6-*54.8*-63.5 (-80) µm long (s= 8.29, N= 31, n= 15), (1.8-)2.1-*2.5*-3.1 (-3.4) µm wide (s= 0.682, N= 31, n= 15)	(36-)41.6-*51.8*-65.4 (-75) µm long (s= 7.29, N= 25, n= 15), (1.5-)2.2-*2.5*-2.9 (-3.5) µm wide (s= 0.371, N= 25, n= 15)
Spores (Ekman & Nordin 1993)	————	(42-)50-*67*-85(-109) x (2.5-)2.6-*3.0*-3.4 (-4.3) µm	(46-)53-*59*-70(-84) x (2.4-)2.6-*3.0*-3.6 (-4.2) µm

Table I. Main distinguishing characters between *B. parathalassica, B. fraxinea and B. rubella*. (+ = dissolving, and – = not dissolving).

Specimens examined:

Bacidia parathalassica Llop & Gómez-Bolea: **GREECE:** RHODES Ialissos on the Philerinos mountains, c. 10 Km SW of the city of Rhodes, on the trunk of *Cupressus sempervirens* in an avenue near to the monastery, northern exposure, alt. 250 m, 6 x 1984, *M. S. Christiansen* 84.191 (C 4492, sub *Bacidia rosella*). **MOROCCO:** Maraboul malcelieu près Tètouan, olivier [on *Olea*], 27 vi 1930, *R.G. Werner* (BC, sub *Bacidia rosella*). **SPAIN:** CÁDIZ: Tarifa, Sierra de Saladavieja, Cañada de la Jara, on

Quercus suber, U.T.M.: 30STF6201, alt. 140 m, 18 x 1992, *S. Fos* (VAB-LICH 335, sub *Bacidia rubella*).- Idem, El Tiradero, on *Quercus suber*, U.T.M.: 30STF6705, alt. 200 m, 17 x 1992, *S. Fos* (VAB-LICH 3853 and 3967 sub *Bacidia rubella*). MALLORCA: The southeastern coast between Cala Marsal and Cala Brafi, c. 17 Km SSW of Porto Cristo, on *Juniperus phoenicea* near the seashore, 22 v 1972, *R. Santesson* (UPS 24093, sub *B. rubella*).- Cabo de Salinas, at the lighthouse, on trunks of *Juniperus phoenicea* sheltered side of stands at the shore, with *Pinus halepensis*, 24 v 1975, *L. Tibell* (UPS 6016, sub *B. rubella*). MENORCA: Alaior, Cala de Sant Llorenç, on *Juniperus phoenicea*, U.T.M.: 31SEE9315, alt. 1-5 m, 6 vii 1993, *A. Gómez-Bolea* (BCC-Lich.)- Ciutadella, Cala Morell, near Ses Coves, on *Juniperus phoenicea*, U.T.M.: 31SEE7533, alt. 30 m, 1 vii 1993, *A. Gómez-Bolea* (BCC-Lich.).- Idem, Barranc de l'Algendar, near l'Algendar Vell, on *Quercus ilex*, U.T.M.: 3331SEE8325, alt. 70-100 m, 2 vii 1993, *A. Gómez-Bolea* (BCC-Lich.).- Idem, Barranc de Cala Galdana, on *Olea europaea*, U.T.M.: 31SEE8224-8223, alt. 10-30 m, 3 vii 1993, *A. Gómez-Bolea* (BCC-Lich.).- Idem, Cala d'Algaiarens, on *Juniperus phoenicea, Phyllirea* sp. and *Quercus ilex*, U.T.M.: 31SEE7833, alt. 0-10 m, 5 vii 1993, *A. Gómez-Bolea* (BCC-Lich.).- Idem, Cap Menorca, between Cap de Banyos and Punta d'Es Canaló, on *Ficus carica*, *Ceratonia siliqua* and *Rhamnus alaternus*, U.T.M.: 31SEE6728-6828, alt. 5m, 7 vii 1993, *A. Gómez-Bolea* (BCC-Lich.).- Ferreries: Santa Àgueda, on *Juniperus phoenicea*, U.T.M.: 31SEE8531, alt. 100-150 m, 2 vii 1993, *A. Gómez-Bolea* (BCC-Lich.).- Idem, Es Clot, between the barranc de Trebeluger and the Barranc de Sa Cova, on *Quercus ilex* and *Populus alba*, U.T.M.: 31SEE8523-8522, alt. 50 m, 6 vii 1993, *A. Gómez-Bolea* (BCC-Lich.). TARRAGONA: Querol (Alt Camp), Puig de Montagut, on a dead trunk of *Quercus faginea*, U.T.M.: 31TCF6885, alt. 850 m, 13 iii 98, *E. Llop* (BCC-Lich.).

Bacidia fraxinea Lönnr.: (UPS 132425 and L-10204/l-0039912 *Lectotypus*). **PORTUGAL:** Estremadura. Prope Boca do Inferno (Cascais), *ad cortices cupressorum cultarum*, alt. 30 m. 31 xi 1964. *C.N. Tavares*, Lichenes Lusitaniae selecti exsiccati Nº 210 (GZU-PO-P1 and H, sub *Bacidia luteola* (Schrad.) Mudd var. *porriginosa* (Turn.) Oliv.). **SPAIN:** ALAVA: Laezan, on an old trunk of *Quercus* sp. about 250 cm high, U.T.M.: 30TWN3417, alt. 1000 m, 24.iii.1983, *J. Etayo* (VIT-493).- Maturana, on *Quercus faginea, Pulmonario-Quercetum faginae,* alt. 520 m, 1 viii 1983, *B. Aguirre*, (BIO-Asco 014 sub *Bacidia rubella*).- Ozaeta, Marieta, found on *Quercus* x sp. with *Opegrapha lichenoides*, U.T.M.: 30TWN3752, alt. 560 m, 7 xii 82, *J. Etayo* (VIT-281, sub *Bacidia fallax*). CÁDIZ: Tarifa, Sierra de Saladavieja, Cañada de la Jara, on *Quercus suber*, U.T.M.: 30STF6201, alt. 140 m, 18 x 1992, *S. Fos* (VAB-LICH 9300, sub *Bacidia naegelii*). CASTELLÓ: Bojar, on *Quercus ilex*, U.T.M.: 31TYL560072, alt. 1100 m, 2 xi 1986, *V. Atienza* (VAB-LICH 932, sub *Bacidia rosella*).- Pobla de Benifassar, on *Quercus ilex*, U.T.M.: 31TBF695043, alt. 750 m, 28 viii 1984, *V. Atienza* (VAB-LICH 933, sub *Bacidia rosella*).- Idem. 2 xi 1985, *V. Atienza* (VAB-LICH 934, sub *Bacidia rosella*).- Vallibona, Convento de Sto. Domingo, on *Quercus ilex*, U.T.M.: 31TBF505001, alt. 700 m, 29 vi 1987, *V. Atienza* (VAB-LICH 931, sub *Bacidia rosella*). LLEIDA: Àger, Km 24 carretera a Les Avellanes, on *Quercus rotundifolia,* 31TCG15, alt. 600 m, 3 viii 1984, *A. Gómez-Bolea* (BCC-Lich. 11526, sub *Bacidia rosella*).- Idem, Camping Badia, on *Buxus sempervirens* near the swimming pool, U.T.M.: 31TCG15, alt. 600 m, *A. Gómez-Bolea* (BCC-Lich. 11711, sub *Bacidia rosella*).- Alt Urgell. Cadí, Cornellana, on *Salix* sp., U.T.M.: 31TCG77, 21 vii 77*, A. Gómez-Bolea* (BCC-Lich. 2927, sub *Bacidia assulata*).- Mafet, carretera C-240, Km 9-10, on *Quercus rotundifolia,* U.T.M.: 31TCG34, alt. 350 m, 10 xi 1994, *E. Llop* (BCC-Lich.).- Os de Balaguer, Montsec, on *Quercus faginea,* U.T.M.: 31TCG13, alt. 550 m, 4 viii 84, *A. Gómez-Bolea* (BCC-Lich. 11545, sub *Bacidia rosella*).- Sanaüja, on the basis of *Quercus cerrioides,* U.T.M.: 31TCG63, alt. 450 m, 30 iii 84, *A. Gómez-Bolea* (BCC-Lich. 11170, sub *Bacidia rubella*). -Ibid., on *Quercus cerrioides,* alt. 400 m, 30 iii 1984, *A. Gómez-Bolea* (BCC-Lich. 3432, sub *Bacidia rosella*). MALLORCA:- La Albufera, on *Pinus halepensis,* 3 iv 1969, P. Onsberg. (C-875, sub *Bacidia luteola*). MENORCA:- Ciutadella, Cala d'Algaiarens, on *Pinus halepensis*, U.T.M.: 31SEE7833, alt. 0-10 m, 5 vii 1993, A. Gómez-Bolea (BCC-Lich.).- Idem, near Son Planes, on *Quercus ilex*, U.T.M.: 31SEE7930, alt. 70-80 m, 5 vii 1993, *A. Gómez-Bolea* (BCC-Lich.). TARRAGONA: Arnes, Barranc del Grevolar (Serra dels Ports), on *Ulmus glabra,* U.T.M.: 31TBF7125, alt. 800-900 m, 20 x 1990, M. Boqueras (BCC-Lich. 6160, sub *Bacidia rubella*).- Conca de Barberà, Poblet, La Pena, on *Acer monspessulanus*, U.T.M.: 31TCF48, alt. 600-900 m, 30 iii 1980, *A. Gómez-Bolea* (BCC-Lich. 3016, sub *Bacidia rubella*).- Horta de Sant Joan, riu d'Estrets (Serra dels Ports), on *Quercus ilex*, U.T.M.: 31TBF7427, alt. 600 m, 10 ii 1991, M. Boqueras (BCC-Lich. 6011, sub *Bacidia rubella*).- La Sènia, El Retaule, on *Quercus ilex*, U.T.M.: 31TBF6914, alt. 110 m, 21 ix 1986, *V. Atienza* (VAB-LICH 929, sub *Bacidia rosella*).- Idem, on *Acer opalus*, 6 iv 1985, *V. Atienza* (VAB-LICH 935, sub *Bacidia rubella*).- Punta de la Mora, on *Juniperus phoenicea* ssp. *lycia*, U.T.M.: 31TCF5954, alt. 20 m, 10 ii 1987, M. Giralt (BCC-Lich. 3731, sub *Bacidia rosella*). VALENCIA: Alzira, Sierra de Corbera, on *Juglans regia* with *Opegrapha atra*, U.T.M.: 30SYJ2834, alt. 400 m, 26 xi 1980, *V. Atienza* (VAB-LICH 5750, sub *Bacidia rubella*). **SWEDEN:** GOTLAND, Vänge, Ganderve, 1853, K.J. Lönnroth, UPS 132425 (L 74547, *lectotypus* S. Ekman 1992). GOTLAND, on *Fraxinus*, *Leg*. Stenhammer, Lichenes Sueciae exsicc. 53b. L-10204/l-0039912 (*lectotypus* S. Ekman 1992).- Västkinde, *in cortice*

populi. 1921/6 17(a).- Västerheide Stenstugn. *In cortice fraxini.* 1920/6 17(b), *Malme* (LD 97044-0785, sub *Bacidia rubella* var. *porriginosa*).- Vallstenapar, Norrgarde forest meadow, c. 0'6 Km N the farm Bjärs and c. 1'5 Km SSE Bäl church. 57° 37' N 18° 38' E, on *Ulmus minor*, 9-10 viii 1990, A. Nordin, R. Sundin & G. Thor (n. 823), (LD 97044-0786).- Lojsta sn, pä torn vid Lojsta Kyrka (the church), vi 1987, *U. Arup & S. Ekman* (L/20, LD 97044-0787).

Bacidia rubella (Hoffm.) Massal.: **PORTUGAL:** ESTREMADURA, Arrededores de Setùbal-Almelão, sôbre *Cupressus*, 23 ix 1943, *L. G. Sobrinho* (Herb. C.N. Tavares, sub *Bacidia luteola*). **SPAIN:** ARAGÃO, Alcalá de la Selva, sôbre o ritidoma de *Juniperus*, 29 vi 1955, *C.N. Tavares* (MA-Lich 00680, sub *Bacidia luteola* var. *porriginosa*). ALAVA: Mtes. Vitoria, Bemostegueta, alt. 640 m, E-SE, on *Quercus faginea, Pulmonario-Quercetum faginae*; iluminado y abierto, 13 vii 1983, *B. Aguirre* (BIO-ASCO 015). BARCELONA: Serra de Montseny, Hänge EN der Paßhöhe des Coll Formich. a) *Quercetum pubescentis*, ca. 1200 m. b) Triften und niedere Schieferblöcke am Grat, ca. 1200-1300 m. 28 v 1983, *J. Hafellner* 17340 (GZU Sp-87). CASTELLÓ: Morella, Mas del Bellmunt, on *Quercus faginea*, U.T.M.: 30TYK5082, alt. 1020 m, 27 ix 1984, *V. Atienza* (VAB-LICH 936). CADIZ: Jerez de la Frontera, before Puerto Gáliz, cta. C-3331, km 40, dehesa de *Quercus canariensis*, quejigales, acid substratum, on *Quercus canariensis*, U.T.M.: 30STF7552, alt. 675 m, 17 iv 1994, *E. Llop* (BCC-Lich.).- Idem, cta. C-3331, Km 41, U.T.M.: 30STF7552, alt. 675 m, on *Quercus canariensis*, 17 iv 1994, E. Llop (BCC-Lich.). MALAGA: Ronda, Sierra de las Nieves, Cañada del Cuerno, next to Cortijo de los Quejigales, on *Abies pinsapo*, U.T.M.: 30SUF1863, alt. 1450-1560 m, 16 iv 1994, *E. Llop* (BCC-Lich.). NAVARRA: Alcoz, valle de la Ulzama, forest track departing from the Danone factory, *Crataego laevigatae-Quercetum roboris*, trunk of *Quercus robur*, U.T.M.: 30TXN0962, alt. 560 m, *J. Etayo* (MA-Lich 3710). -Alto de Lizarraga. alt. 1000 m, *Fagus sylvatica* and *Quercus petraea, J. Etayo* (MA-Lich 3709).- Abárzuza, 500 m pista del Monasterio de Iranzu, alt. 900 m, *Quercus rotundifolia,* 12 x 1993, *J. Etayo* (MA-Lich 4432).- ibid., wood of *Quercus pubescens* (MA-Lich 4401).- ibid., on *Quercus pubescens* and wood of it (MA-Lich 4379).- Bacaicoa, corredor de la Barranca, bosquete cerca de la carretera, alt. 500 m, on *Quercus robur*, 26 vi 1993, *J. Etayo* (MA-Lich 4159).- Orbaiceta, Selva de Irati, 2 km E of Orbaiceta, Valle del río Irati, alt. 800-900 m, *Fagus-Quercus petraea* forest (*Saxifrago hirsutae-Fagetum*), on S slope, on *Q. petraea*. Atlas Fl. Eur. Grid.: XN1. 7 ix 1991, *T. Ahti & Ana Rosa Burgaz* (H-50672).- Amezkoa baja, Zudaire, alt. 640 m, 5 viii 1984, *B. Aguirre* (MAF-2008).- Leazue, on a lonely oak, 29 xi 1984, *J. Etayo* (BCC-Lich. 3000, sub *Bacidia fallax*). GUIPUZCOA: Legazpia, presa de Barendiela-Uderraetxeberri; alt. 450 m., orient. NW 320, on *Quercus robur*, 5 ii 1984, *B. Aguirre* (MAF-3511, sub *Bacidia biatorina*). LLEIDA: Vielha et Mijaran, Bosc de Conangles, on *Acer* cf. *platanoides*, U.T.M.: 31TCH13, alt. 1700-1800 m, 19 iv 1984, *A. Gómez-Bolea* (BCC-Lich. 11383). MALLORCA: Gorg Blau, on *Quercus ilex*, 6 i 1984, *M. Giralt* (BCC-Lich.). MENORCA: Ciutadella, Cap Menorca, between Cap de Banyos and Punta d'es Canaló, on *Rhamnus alaternus,* U.T.M.: 31SEE6728-6828, alt. 5 m, 7 vii 1993, *A. Gómez-Bolea* (BCC-Lich.).- Idem, Cala Morell, near Ses Coves, on *Juniperus phoenicea*, U.T.M.: 31SEE7533, alt. 30 m, 1 vii 1993, *A. Gómez-Bolea* (BCC-Lich.).- Alaior, Cala de Sant Llorenç, on *Juniperus phoenicea*, U.T.M.: 31SEE9315, alt. 1-5 m, 6 vii 1993, *A. Gómez-Bolea* (BCC-Lich.).- Ferreries, Santa Àgueda, on *Quercus ilex*, 31SEE8531, alt. 100-150 m, 2 vii 1993, *A. Gómez-Bolea* (BCC-Lich.).- Idem, Es Clot, between the Barranc de Trebeluguer and the Barranc de Sa Cova, on *Quercus ilex*, U.T.M.: 31SEE8523-8522, alt. 50 m, 6 vii 1993, *A. Gómez-Bolea* (BCC-Lich.). **SWEDEN:** Bohuslän, Odsmål, the old church-yard, on *Aesculus*, 30 vii 1932, (Coll. A. H. Magnusson, Swedish Lichens 1340, BC). **SYRIA**: Alouites, Monts Ansarich, cedretum au dessus de Sleufé, alt. 1200-1300 m, sur *Acer* sp. 5 ix 1938, *R. G. Werner* (BC, Lichenes libano-syriaci).

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THREE NEW SPECIES IN THE AUSTRALIAN GRAPHIDACEAE WITH NOVEL CHEMISTRIES: PHAEOGRAPHINA ECHINOCARPICA, PHAEOGRAPHIS NECOPINATA, AND PHAEOGRAPHIS NORNOTATICA

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ABSTRACT: *Phaeographina echinocarpica* A.W. Archer & Elix (with echinocarpic acid), *Phaeographis necopinata* A.W. Archer & Elix (with hypostictic acid) and *Phaeographis nornotatica* A.W. Archer & Elix (with 4-*O*-demethylnotatic and hypoprotocetraric acids) are described as new Australian species in the Graphidaceae. A plausible scheme for the biosynthesis of these compounds from common precursors is presented.

INTRODUCTION

The chemistry of the lichen family Graphidaceae is apparently relatively simple with few lichen compounds so far reported. The two most frequently reported compounds are norstictic and stictic acids, although protocetraric acid, psoromic acid, salazinic acid, lecanoric acid and lichexanthone are also found in species in this family (Wirth & Hale 1978). Norstictic and stictic acid are the only two lichen acids so far reported from the genera *Phaeographina* and *Phaeographis*.

In the course of an examination of a number of specimens in the family Graphidaceae from Queensland [north-eastern Australia] three specimens were found which, when examined by thin-layer chromatography, showed the presence of compounds other than those listed above. A more detailed examination by liquid chromatography identified the compounds as echinocarpic acid (in a *Phaeographina* species) and 4-*O*-demethylnotatic acid and hypoprotocetraric acid (in a *Phaeographis* species) and hypostictic acid in a second *Phaeographis* species.

The specimens examined were collected in north-eastern Australia in 1984 and 1995. The chemistry of the specimens was determined by thin-layer chromatography (Elix & Ernst-Russell 1993) and liquid chromatography (Feige *et al.* 1993).

NEW SPECIES:

Phaeographina echinocarpica A.W. Archer & Elix Fig. A

Sicut *Phaeographina quassiaecola* (Fée) Müll. Arg. sed ascosporis majoribus et acidum echinocarpicum continens.

TYPE: AUSTRALIA. QUEENSLAND: Mount Baldy, 4 km SW of Atherton, 17°17'S, 145°27'E, alt. 1080 m, in old *Araucaria* plantation and regrowth rainforest, on *Alphitonia*, *J.A. Elix 16275*, 25.vi.1984); holo: CANB.

Thallus pale olive green, thin, corticolous, surface smooth and shiny. Lirellae conspicuous, numerous, scattered, sessile, greyish black, with conspicuous thalline margin, curved or sinuous, sometimes branched, 1-7 mm long, 0.7-0.9(-1.0) mm wide. Proper exciple laterally carbonised, red-brown at the base; hymenium 200-250 µm tall. Ascospores 1 per ascus, pale brown, elongate ellipsoid, 162-200 µm long, 30-40 µm wide, muriform (*ca*. 20- x 5-6-locular), halonate (4-5 µm thick).

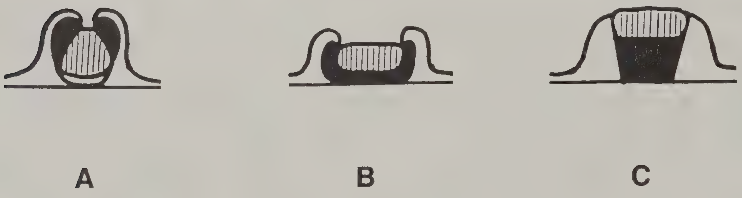
CHEMISTRY: echinocarpic acid (major) and 4-*O*-methylechinocarpic acid [conechinocarpic acid] (minor).

Phaeographis echinocarpica is characterised by the large pale brown, halonate ascospores, the conspicuous lirellae and the presence of echinocarpic acid. The carbonised proper exciple is covered with a thin thalline layer thus giving the lirellae a greyish black appearance.

Echinocarpic acid is an uncommon benzyl ester distinguished from other esters of this type, such as alectorialic acid and barbatolic acid, by ester formation involving an *ortho*- rather than a *meta*-hydroxymethyl group in the B-ring (Elix *et al.* 1995). Echinocarpic acid has so far been reported only from the Parmeliaceae.

The new species is distinguished from other *Phaeographina* species with large ascospores by the presence of echinocarpic acid. *Phaeographina montagnei* (v.d. Bosch) Müll. Arg. and *P. macrospora* (Zahlbr.) Nakanishi both have large ascospores, 115-180 µm long, but both species lack lichen compounds (Nakanishi 1966).

The new species is so far known only from the type specimen.



Diagramatic cross-sections of lirellae.

A: *Phaeographina echinocarpica*
B: *Phaeographis necopinata*
C: *Phaeographis nornotatica*

Phaeographis necopinata A.W. Archer & Elix Fig. B

Sicut *Phaeographis dendritica* (Ach.) Müll. Arg. sed acidum hyposticticum continens.

TYPE: AUSTRALIA. QUEENSLAND: Great Dividing Range, Mount Baldy, 4 km SW of Atherton, 17°17'S, 145°27'E, alt. 1080 m, in old *Araucaria* plantation and regrowth forest, on *Alphitonia*, *J.A.Elix 16233*, 25.vi.1984; holo: CANB.

Thallus pale fawn to pale olive green, thin, corticolous, surface smooth and shiny.

Lirellae conspicuous, scattered or rarely clustered, sessile, open, black with a conspicuous thalline margin, straight, curved or sinuous, rarely branched, 1-4(-5) mm long, 0.3-0.5 mm wide. Proper exciple completely carbonised, concealed in thalline margin. Hymenium 125-150 µm tall. Ascospores 8 per ascus, irregularly 2-seriate, pale brown, rounded cylindrical, (25-)30-40 µm long, (8-)9-12 µm wide. (7-)8-locular.

CHEMISTRY: hypostictic acid (major), conhypoprotocetraric acid (trace), and hyposalazinic acid (trace).

Specimens examined:
AUSTRALIA. QUEENSLAND: Main Coast Range, track to Mount Lewis, 19 km NNW of Mount Molloy, 16°31'S, 145°16'E, alt. 1200 m, in rainforest on fallen tree, *J.A. Elix 16922*, 30.vi.1984 (CANB); *ibid*., Windmill Creek, 14 km NNW of Mount Molloy, 16°34'S, 145°17'E, alt. 1000 m, on *Ficus*, *J.A. Elix 16955*, 30.vi.1984 (CANB); Lamb Range, 21 km NE of Atherton, 17°07'S, 145°35'E, alt. 1180 m, *J.A. Elix 16598 p.p.*, 27.vi.1984 (CANB).

Phaeographis necopinata is characterised by the conspicuous lirellae, asci with eight ascospores and the presence of hypostictic acid. The lirellae may be terminally rounded or acute and the ascospores are predominantly 8-locular. Superficially the new species resembles *Phaeographis dendritica* (Ach.) Müll. Arg. but is distinguished from that species by the presence of hypostictic acid. Hypostictic acid is an uncommon compound in the Graphidaceae and is also found in the holotype of *Graphina albostriata* (Vain.) Zahlbr. (TUR-V 27177) and in a syntype of *Graphina pseudosophisticata* (Vain.) Müll. Arg. (TUR-V 27244A) (Archer & Elix, unpublished results). These two taxa are conspecific.

The epithet *necopinata* is from the Latin *necopinatus*, unexpected, a reference to the presence of hypostictic acid in the new species.

Phaeographis nornotatica A.W. Archer & Elix Fig.C

Sicut *Phaeographis exaltata* (Mont. & v.d. Bosch) Müll. Arg. sed apotheciis majoribus et acidum nornotaticum continens.

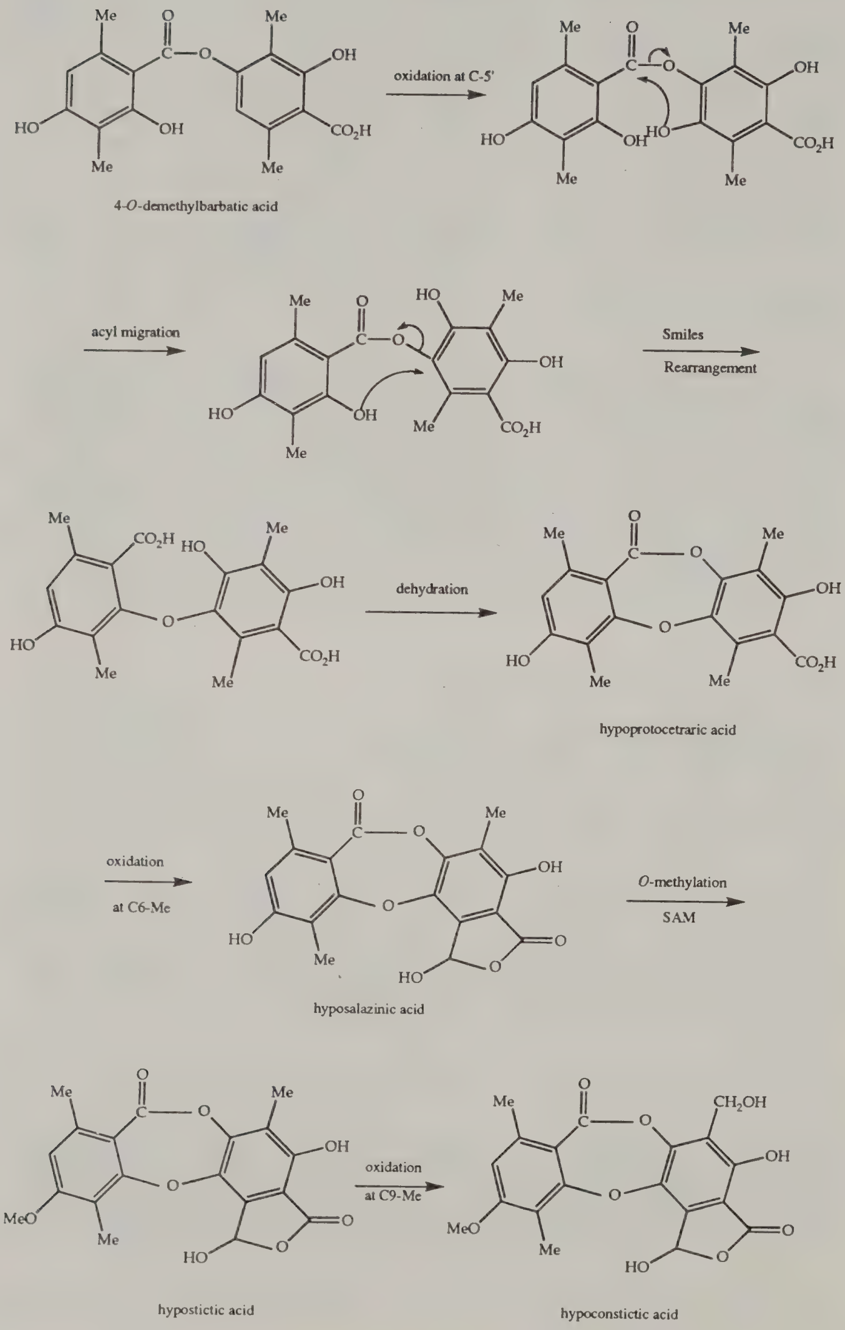
TYPE: AUSTRALIA. QUEENSLAND: McIlwraith Range, Llankelly Creek, 9 km NE of Coen, 13°53'S, 143°16'E, alt. 530 m, *H. Streimann 56937*, 18.x.1995; holo: CANB.

Thallus dull fawn, thin, corticolous, surface smooth and shiny (chondroid). Apothecia lirelliform, conspicuous, scattered, sessile, black, straight, curved or sinuous, sometimes branched, with a conspicuous thalline margin, open, disc black, fine white pruinose, 1-4(-6) mm long, 0.5-0.7(-0.9) mm wide, 0.4-0.5 mm tall. Proper exciple completely carbonised, laterally thin, the base thick, *ca*. 250 µm tall, tapering towards the base; hymenium *ca*. 100 µm tall. Ascospores 8 per ascus, pale brown, rounded cylindrical, 21-25 µm long, 6-7 µm wide, 6-locular.

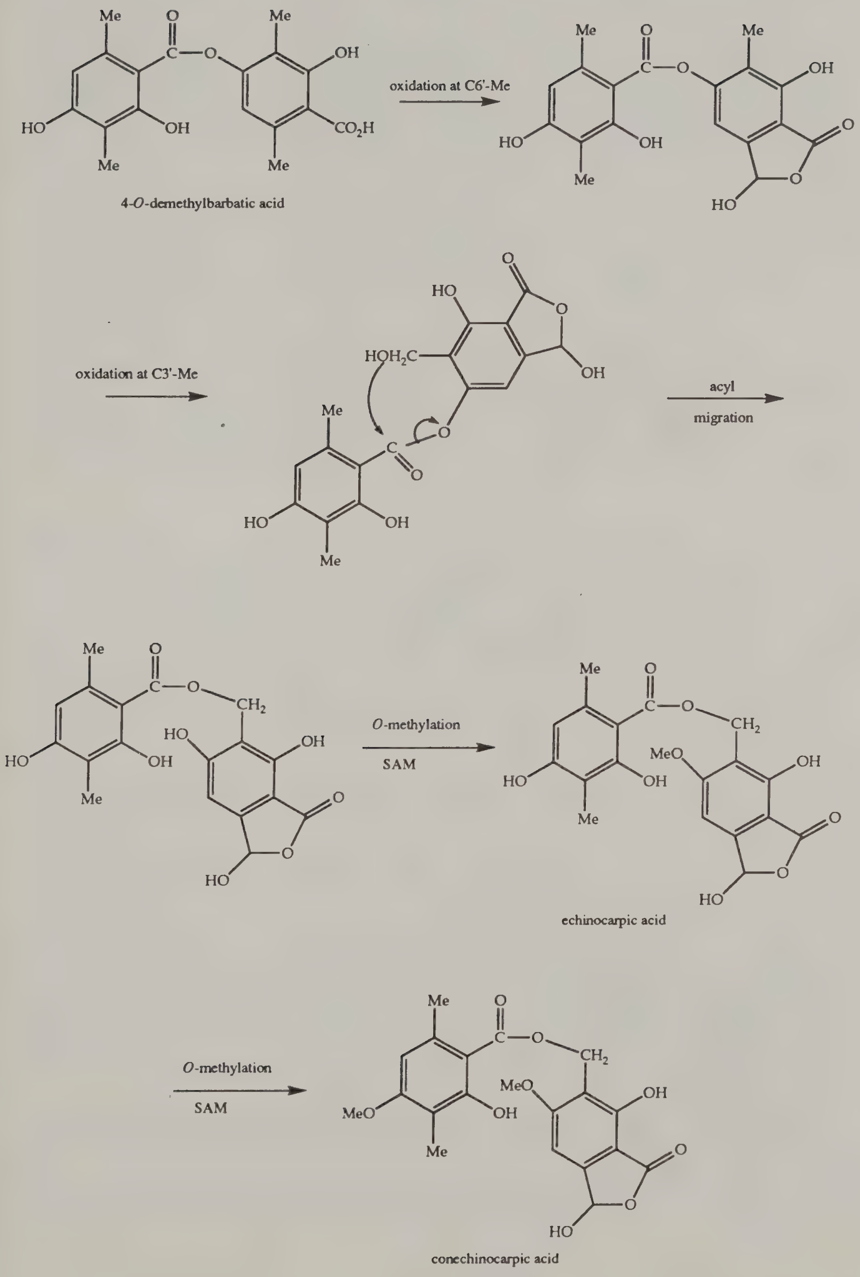
CHEMISTRY (tlc & hplc): 4-*O*-demethylnotatic acid [nornotatic acid] (major) and hypoprotocetraric acid (minor).

Phaeographis nornotatica is characterised by the large conspicuous lirellae, the tapering base of the proper exciple and the presence of nornotatic acid. The species somewhat resembles *P. exaltata* (Mont. & v.d. Bosch) Müll. Arg. but the lirellae are larger and taller, and the proper exciple and the chemistry differ. *Phaeographis exaltata* lacks lichen compounds. The new species is so far known only from the type locality.

SCHEME A


4-O-demethylbarbatic acid
oxidation at C-5'
acyl migration
Smiles Rearrangement
dehydration
hypoprotocetraric acid
oxidation at C6-Me
hyposalazinic acid
O-methylation SAM
hypostictic acid
oxidation at C9-Me
hypoconstictic acid

SCHEME B


4-*O*-demethylbarbatic acid
oxidation at C6'-Me
oxidation at C3'-Me
acyl
migration
O-methylation
SAM
echinocarpic acid
O-methylation
SAM
conechinocarpic acid

CHEMICAL VARIATION IN THE GRAPHIDACEAE

It is apparent that in general representatives of the Graphidaceae exhibit a propensity for the production of β-orcinol depsidones (such as stictic and norstictic acids) and β-orcinol benzyl esters (e.g. echinocarpic and conechinocarpic acids).

While it is accepted that β-orcinol depsidones such as hypoprotocetraric acid and the co-occurring 4-*O*-demethylnotatic acid are derived by nuclear oxidation of the isostructural β-orcinol depsides 4-*O*-demethylbarbatic acid and norobtusatic acid (Culberson & Hale 1973; Elix *et al.* 1987; Mosbach 1969, 1973), the precise mechanism of this process remains to be elucidated, although a convincing hypothesis has been suggested as illustrated in Scheme A (Elix *et al.* 1987). However, many other common β-orcinol depsidones, particularly those with more highly oxidized C-1 side chains, are believed to arise biosequentially from hypoprotocetraric acid (and 4-*O*-demethylnotatic acid) by stepwise oxidation reactions (Elix & Yu 1993; Keogh 1978).

It is interesting to speculate how species of the Graphidaceae (and Parmeliaceae) are effective in producing both β-orcinol depsidones and β-orcinol benzyl esters with highly oxidized side chains. It is our view that the latter compounds are also derived biosynthetically by oxidation of β-orcinol depsides such as 4-*O*-demethylbarbatic acid, only in this case oxidation proceeds in various side-chain positions with no nuclear oxidation. In particular, oxidation of the 3'-methyl group would be followed by facile acyl migration to give the isostructural benzyl ester (Scheme B). Subsequent *O*-methylation by *S*-adenosylmethionine would then lead to the observed echinocarpic and conechinocarpic acids. This being the case, the same pool of mononuclear precursors (e.g. β-orsellinic acid) could lead to the corresponding β-orcinol depsides and thence to both β-orcinol depsidones and β-orcinol benzyl esters depending upon the initial site of oxidation (i.e. nuclear oxidation at C-5' or side-chain oxidation at C-3').

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CARBONEA HERTELII (LECANORACEAE, LECANORALES, LICHENIZED ASCOMYCOTINA), A NEW SPECIES FROM THE ANDES

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Abstract: A description is presented for *Carbonea hertelii* Knoph sp. nov. At the present this species is known only from the type locality in the Andes (Venezuela).

Introduction

Carbonea was established as a subgenus of *Lecidea* by HERTEL (1967). The 'carbonized' excipulum, in combination with some other characters, was used to separate this subgenus from the other subgenera of *Lecidea*. HERTEL (1983) gave *Carbonea* the status of a genus, which he placed, due to ascus characters, into the family Lecanoraceae s. l. In his work he also added to this genus two lichenicolous species without any visible proper thallus, which were formerly categorized under *Nesolechia* and *Lecidea*. Further taxa were placed in *Carbonea* by ALSTRUP (in ALSTRUP et al. 1994), BRUSSE (1994), DIEDERICH & TRIEBEL (in HAFELLNER 1993, SANTESSON 1993), HAFELLNER & HERTEL (in WIRTH 1987), HAFELLNER & OBERMAYER (in OBERMAYER 1993), HAFELLNER & SANCHO (1990), HALE (1987), HERTEL (1984a, 1984b), KNOPH & RAMBOLD (in KNOPH & LEUCKERT 1994) RAMBOLD & KNOPH (in RAMBOLD 1989), RAMBOLD & TRIEBEL (in APTROOT et al. 1997). During the revision of non-saxicolous specimens of the genus *Lecidella*, a new species from the Andes was discovered, for which a description is presented.

Materials and Methods

The specimen analyzed for this study was taken from the herbarium M (Botanische Staatssammlung München). The chemistry was examined by means of thin-layer chromatography (TLC) using the standardized methods of CULBERSON (1972). In addition, the sample was studied using lichen mass spectrometry as described in LEUCKERT et al. (1990). Morphological and anatomical characters were examined with Zeiss binocular microscopes (6,5 - 50x, and 32x, 63x, 125x, 250x, 500x, 1000x) (for terminology and measurement see POELT (1969), HERTEL (1977) and PRINTZEN (1995)). Apothecial anatomy was studied in 10-15 µm thick vertical sections (Leitz freezing microtome) mounted in water or in lactophenol and stained with cotton blue. Tests for amyloid reactions were done by mounting sections in Lugol's solution.

Carbonea hertelii Knoph sp. nov.

Diagnosis: Apothecia atra, usque ad 1.0 mm in diametro, disco primum plano, dein paulo convexo, atro, margine tenui, atro, persistente. Excipulum in sectione transversali circa 35 - 80 µm crassum, in parte exteriore viridiatrum vel violaceum, in parte interiore rubrofuscum vel subviolaceum. Hypothecium flavofuscum, ad basis fuscum vel rubrofuscum, 80 - 120 (160) µm altum. Hymenium hyalinum, 55 - 70 µm altum. Epihymenium coeruleum vel viridiatrum. Paraphyses ramosae et valde anastomosantes, 1.5 - 2.0 µm crassae, apicibus incrassatis, 2.0 - 4.0 µm latis. Asci c. 45 - 50 µm longi et 15 - 25 µm lati. Tholus amyloideus et massam axialem non amyloideam exhibens. Ascosporae ellipsoideae, unicellulares, 11.5 - 16.0 µm longae, 6.0 - 7.5 µm latae.

Type: VENEZUELA: Estado Mérida: Sierra de Santo Domingo, Paramo de Mucubaji, Straße nach Pinango, 1 km NW des Passo El Aguila, an toter *Espeletia lutescens*, [8°48'N, 70°50'W], 4200 m, 22 April 1969, *H. Hertel 10775 & B. & F. Oberwinkler* (M).

Description: Thallus: rimose to areolate, up to 3.0 cm diam., up to c. 0.5 mm thick. Areoles irregularly shaped to roundish, whitish, with sometimes bullate surface, c. 0.2 - 0.6 mm diam. Cortex c. 25 µm thick; upper cell layer not pigmented; hyphae c. 4.5 µm diam.; epinecral layer not developed. Algal layer up to c. 150 µm thick; algal cells c. 8 - 12 µm, max. 16 µm diam. Medulla I_{Lugol} -; hyphae c. 4.5 µm thick. Hypothallus not obvious.

Apothecia: roundish, dispersed to crowded, more or less constricted at the base, c. 0.5 - 0.7 mm, max. 1.0 mm diam. Disc plane to slightly convex, black, matt to nitid, epruinose. Margin distinct from the beginning, mostly persistent, black, nitid. Excipulum lateral of hymenium c. 35 - 80 µm thick. Ectal zone blackish green to violet; pigmented zone c. 15 µm thick; hyphae 3.5 - 5.5 µm diam., with lumina c. 1.5 µm wide. Inner zone orange-brown to violet-brown; hyphae 3.5 - 5.0 µm diam., with lumina c. 1.0 - 1.5 µm wide.

Medullary zone not differentiated. Hypothecium pale yellow-brown to orange-brown, 80 - 120 (- 160) µm thick; hyphae c. 4.0 µm diam. Subhymenial layer ± colourless, c. 20 µm thick. Hymenium 55 - 70 µm thick, colourless, I_{Lugol} ± blue. Epihymenium violet-blue to (greenish) blue, 10 - 20 µm thick. Paraphyses ± branched, often anastomosing, c. 1.5 - 2.0 µm thick; apical cells c. 3.0 - 4.0 µm thick. Asci c. 45 - 50 x 15 - 25 µm; tholus max. 6.5 - 10 µm, min. 4- 6 µm thick; outer amyloid wall layer c. 0.1 µm thick, I_{Lugol} + bluish brown, non-amyloid wall layer c. 1.0 µm thick. Ascospores ellipsoid, 11.5 - 13.9 - 16.0 x 6.0 - 6.9 - 7.5 µm.

Pycnidia: ± globular, immersed to subimmersed, with brown wall cells, c. 125 µm diam. Conidia filiform, 15 - 20 x c. 1.0 µm.

Ecology and distribution: The species is only known from the type locality in Venezuela growing on dead *Espeletia lutescens*.

Chemistry: atranorin (TLC (and MS): trace), zeorin (MS: a minimal trace could not be excluded, but could not be detected by TLC).

Discussion: Within the genus *Carbonea*, *Carbonea hertelii* is characterized by a violet-blue to (greenish) blue epihymenium, a yellow-brown to red-brown hypothecium and the presence of atranorin. *Carbonea hertelii* is anatomically similar to *Carbonea latypizodes* (Nyl.) Knoph & Rambold ined., in that both have yellow-brown to red-brown hypothecia, but *Carbonea latypizodes* ined. has a grey-green to green epihymenium and the pigmentation of the excipulum is less intense than in *Carbonea hertelii*. The chemistry of these species is similar too, in that both have atranorin; however, *Carbonea latypizodes* ined. usually contains 2'-*O*-methylperlatolic acid besides atranorin. In contrast to *Carbonea hertelii*, *Carbonea latypizodes* ined. usually grows on siliceous rock and on sandstone.

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FIRST RECORD OF ANTROMYCOPSIS MACROCARPA FOR BRAZIL

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ABSTRACT

Antromycopsis macrocarpa (Ellis & Everh.) Stalpers, Seifert & Samson, anamorphic state of *Pleurotus cystidiosus* O.K. Miller is recorded for the first time for for Brazil.

Hilber (1982) divided the genus *Pleurotus* (Aphyllophorales, Basidiomycota) in two subgenera, *Pleurotus* and *Coremiopleurotus*. In the latter are included species that in their anamorphic state form synnemata on the stipe of the basidiome or in pure culture and which are classified in the genus *Antromycopsis* Pat. & Trabut. Stalpers *et al.* (1991) revised the genus *Antromycopsis,* recognizing three species with teleomorphs in *Pleurotus*: *A. angustata* Stalpers, Seifert & Samson, *A. guzmanii* Stalpers, Seifert & Samson and *A. macrocarpa* (= *A. broussonetiae* Pat. & Trabut apud Pat.).

The isolate mentioned here proceeds from a basidiome that had developed upon a dead trunk of an angiosperm plant in the Fundação Parque Zoológico of São Paulo. Unfortunately, the basidiome was not preserved. Since the isolation the strain remained in culture medium in the anamorphic state forming synnemata. All attempts to obtain basidiomata in lignocellulosic substrates prepared in the laboratory were negative until now.

The isolate was identified with the help of Stalpers *et al.* (1991) as *Antromycopsis macrocarpa* and the ongoing comparative study with other species of the genera *Antromycopsis* and *Pleurotus* seem to confirm that the teleomorph of this strain is *Pleurotus cystidiosus* O. K. Miller. There is also no record of *P. cystidiosus* for Brazil.

Antromycopsis macrocarpa (Ellis & Everh.) Stalpers, Seifert & Samson, *Can. J. Bot*. 69:7-8, 1991.

Synnema erect, not ramified, 2500-3000(-5000)µm tall; stipe white, 800-2500µm x 300-500µm, sometimes with fan-shaped expansion. Hyphae of the stipe parallel, hyaline, thin-walled, septate, branched, with clamp-connections, apical ends irregular, 4,0-6,0µm wide. Mass of arthroconidia aggregated in a viscose drop, hyaline at first, turning black during maturation of the conidia, 500-1000µm in diam., sometimes coalescent. Arthroconidia of basipetal maturation, ellipsoidal to cylindrical, hyaline, becoming chestnut brown during maturation, smooth, with slightly thickened wall, 16,2x5,7µm. Blastoconidia ellipsoidal to ovoid, hyaline, 2µm in diam., remaining attached to a small denticle that rises from the hypha. Colony white on culture medium, with appressed mycelium, white, with a farinaceous aspect, margin irregular, synnemata formed in concentric rings, starting at the inoculation point; aerial hyphae hyaline, thin-walled, septate, branched, with clamp-connections, 3,0-4,0 µm wide. Figure 1.

Material examined: living culture, CCB067 (CCB - Coleção de Culturas de Basidiomicetos, Instituto de Botânica), coll. V.L.R. Bononi, isol. M. Capelari, 1984, São Paulo, SP, Brazil.

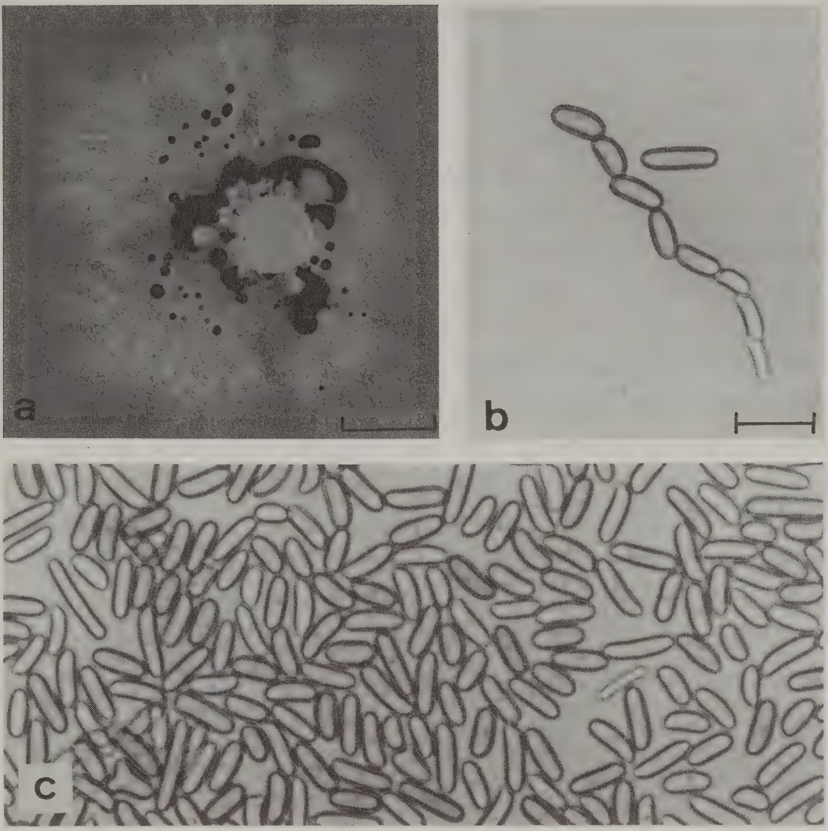

Figure 1. *Antromycopsis macrocarpa* CCB067. a. pure culture with a ring-like group of synnemata in PDA after 19 d at 22°C (bar, 1cm). b. basipetal development of arthroconidia (bar, 20μm). c. arthroconidia (bar, 20μm).

The isolate CCB067 presented differentiated growth depending on the culture medium and the temperature of incubation. The radial growth measured in malt extract agar at 22 and 25°C after two weeks of incubation in the dark (21,9 and 25,5mm, respectively), was faster than that mentioned by Stalpers *et al.* (1991) at room temperature in diffuse light, in the same culture medium. At 30°C the growth of the colony was only 10,3mm. On potato dextrose agar (PDA), the radial growth was 12,8, 22,6 and 14,1mm at 22, 25 and 30°C, respectively. When the culture was incubated in PDA at 22°C, a fan-shaped widening of the stipe of the synnema ocurred in one culture dish. Using the methodology of Käärik (1965) and Stalpers (1978), Okino (1996) verified that the isolate presents a positive reaction for the production of laccase and peroxidase and a negative reaction for tirosinase.

Antromycopsis macrocarpa (its synonym *A. broussonetiae* Pat. & Trabut) and the teleomorph *Pleurotus cystidiosus* O.K. Miller, are recorded for Algeria (holotype of *A. broussonetia*), U.S.A. (Miller, 1969), Greece (Zervakis *et al.*, 1993), India, Indonesia (Stalpers *et al.*, 1991) and Taiwan (Han *et al.*, 1974).

The observations on CCB067 fit perfectly with the description of the anamorphic state of *P. cystidiosus* var. *formosensis* given by Moncalvo (1995), corroborating the conclusion that the teleomorph of this isolate is *P. cystidiosus*.

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LICHENOSTIGMA COSMOPOLITES, A COMMON LICHENICOLOUS FUNGUS ON XANTHOPARMELIA SPECIES

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ABSTRACT: The widely distributed *Lichenostigma cosmopolites* is described as new and its position in that genus is discussed. Earlier records of presumed *Echinothecium reticulatum* on *Xanthoparmelia* species mostly refer to this ascomycete. The fungus lives on a number of *Xanthoparmelia* species and is extremely widely distributed. It is known from all continents but Antarctica.

KEY WORDS: Ascomycotina, Arthoniales, *Lichenostigma cosmopolites*, *Xanthoparmelia*, lichenicolous fungi

Introduction

Lichenicolous ascomycetes whose ascomata are connected with conspicuous vegetative hyphae are known in several orders including Sordariales, Dothideales and Arthoniales. Well known are the superficial hyphal nets of *Echinothecium reticulatum* and several *Sphaerellothecium* species. Similar hyphal strands are also produced by a number of *Lichenostigma* subgen. *Lichenogramma* species. As fissitunicate asci and mostly one-septate ascospores are typical for all these taxa, misinterpretations of species and false determinations of specimens frequently occur.

One of these species, known for a long time but commonly misunderstood, is treated below in detail. Vouaux (1912) was as far as we know the first to report what he supposed to be *Echinothecium reticulatum* Zopf on *Xanthoparmelia conspersa* (Ehrh. ex Ach.) Hale referring to collections made by Arnold and Rieber in northern Italy. This fungus proved to be widespread and was continuously determined as *Echinothecium reticulatum* (see below). More thorough investigations performed by the authors showed that this species is hitherto undescribed and belongs to *Lichenostigma* subgen. *Lichenogramma*. Recently Girlanda et al. (1997) investigated the mycoflora on *Xanthoparmelia somloensis* (Gyeln.) Hale (sub *Parmelia taractica*) applying isolation techniques. The fungus treated here however has not been among the detected fungal taxa or is hidden among the undetermined sterile dematiaceous mycelia.

Material and methods

Dried herbarium specimens, cited together with the treatment of the species, were used. External morphology was studied with a dissecting microscope (WILD M3, 6,4x - 40x), anatomical studies of the thallus and the ascomata were carried out by use of light microscope (REICHERT POLYVAR, 40x - 1000x). Sectioning was performed with a freezing microtome (LEITZ, sections of 12 - 15 mm) but squash preparations were also used especially for ascus analysis. Preparations were mounted in water. When necessary, contrasting was performed by a pretreatment with lactic acid-cotton blue (MERCK 13741). Amyloid reactions in hymenia were observed both progressively and regressively by the use of Lugol's reagent (MERCK 9261). Sections and squash preparations were pretreated with KOH, when hemiamyloidy of hymenial elements was to be checked. Measurements refer to dimensions in ordinary water.

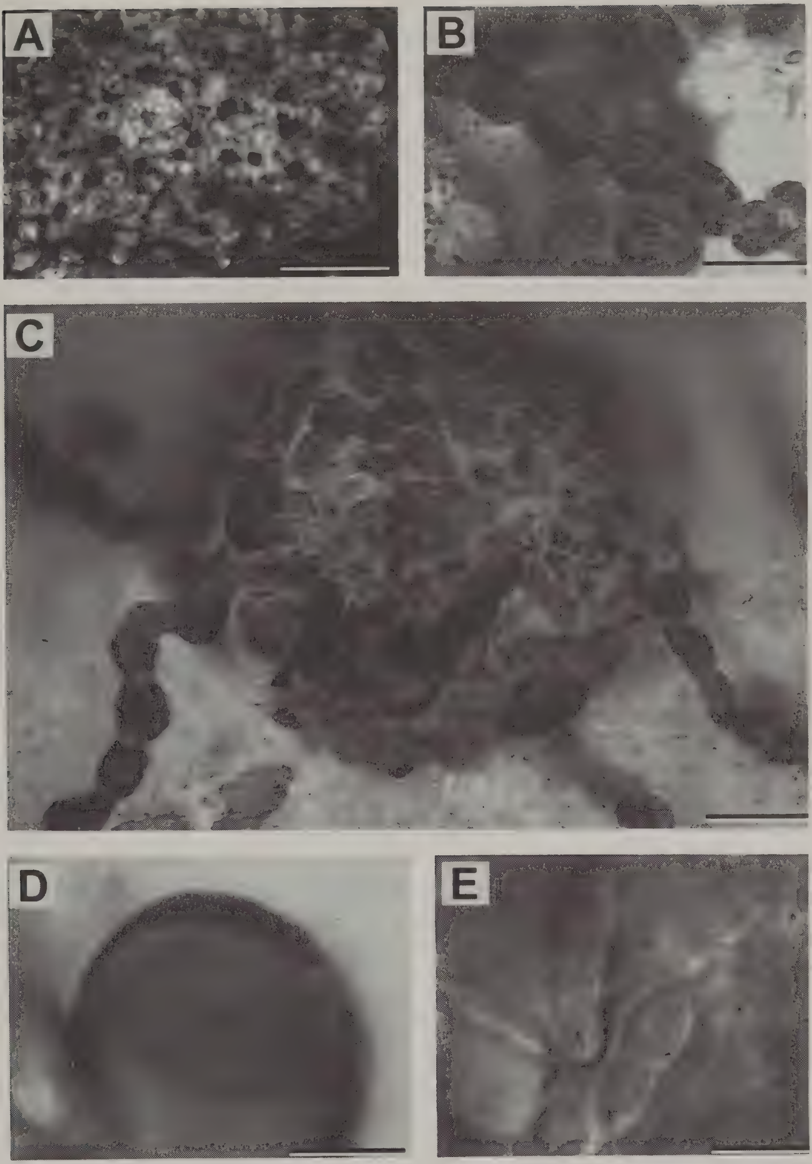
Results

Lichenostigma (subgen. ***Lichenogramma***) ***cosmopolites*** Hafellner & Calatayud spec. nov.

Fungus prima vista *Sphaerellothecium* quisquam valde similis, sed centrum ascomatis hemiamyloideum, asci latiores et ascosporae crassiores. Species differt a *L. maureri*, *L. rugosa* et *L. hyalospora* praesentia hypharum superficialium fuscarum et a *L. elongata* ascomatibus rotundatis et filis superficialibus haud compositis. Habitat supra thallum *Xanthoparmeliarum* diversarum.
Typus: Spain: Prov. Valencia: Serra Calderona, Puçol, El Picaio, U.T.M. 30SYJ3091, 350 m, sobre arenisca, on *Xanthoparmelia tinctina*; 26. II. 1992, V. Calatayud 7982 (VAB - Holotypus).

Vegetative hyphae partly superficial, spreading over the host thallus and rarely also on the apothecial discs, single stranded, dark brown, septate, ramified to net-like, hyphae connecting also the ascomata, slightly constricted at the septa, hyphal cells 6 - 8 (- 10) x (4 -) 5 - 7 µm, upper surface sculptured, sculptural elements punctiform, less then 1 µm in diam., sometimes in short longitudinal rows, additional deeper cracks sometime present (Fig. 1B).
Ascomata superficial, scattered, subglobose to ellipsoid, dark brown to black, rough but without setae (Fig. 1C), 60 - 100 µm wide and 30 - 45 µm tall, opening apically with roundish to irregular ruptures; in longitudinal section outermost cells brown, subglobose, 5 - 7 µm in diam., covered by a granular brown pigment (from the outside cells of ascoma wall with punctiform sculpture), internal cells hyaline, subglobose, 3 - 6 µm in diam., filling up the ascoma. **Interascal filaments** absent.

Fig. 1: *Lichenostigma cosmopolites* A Surface view of a portion of *Xanthoparmelia conspersa* (scale = 0.5 mm). B Superficial hypha (scale = 10 µm). C Ascoma (scale = 20 µm). D Ascus apex showing the reaction of the ascus wall after treatment with KJ and the presence of a ring structure in the endoascus (scale = 5 µm). E Ascospores (scale = 5 µm). (VAB no. 7983).


A
B
C
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E

Asci about 4 – 8 per ascoma, broadly clavate to subglobose, 15 - 20 x 12 - 15 µm, fissitunicate of *Arthonia*-type, ascal wall apically thickened, with large apical dome, 8-spored (Fig. 1D). **Ascospores** hyaline, later brownish with age, 1-septate, lower cell slightly narrower than upper cell, often guttulate, 8 - 10 (- 11) x 3 - 4 (- 5) µm (Fig. 1E), young spores with prominent perispore forming a halo, perisporal sheath later condensing and forming a fine punctiform sculpture on the surface of the spore wall. **Reactions**: Gel of the centrum hemiamyloid, I+ orange-red, K/I+ blue, ascus wall K/I+ bluish around the apex of the ocular chamber but this reaction difficult to see in mature asci, ascal periplasma I+ orange, dextrinoid. All parts K-.

Observed hosts: *Xanthoparmelia conspersa* (1), *X. somloensis* (2), *X. tinctina* (3), *X. chlorochroa* (4), *X. coloradoensis* (5), *X. coreana* (6), *X. cumberlandia* (7), *X. dichotoma* (8), *X. filarszkyana* (9), *X. isidiigera* (10), *X. leonora* (11), *X. tasmanica* (12), *X. mexicana* (13), *X. microspora* (14), *X. multipartita* (15), *X. notata* (16), *X. protomatrae* (17), *X. pseudohypoleia* (18), *X.* cf. *standaertii* (19), *X. subdistorta* (20), *X. substrigosa* (21), *X. succedans* (22), *X. tuberculiformis* (23), *X. ulcerosa* (24), *X. weberi* (25), *X. wildae* (26), *X. wyomingica* (27), *X. maricopensis* (28), *X.* spec. indet. (29).

Discussion: Although it cannot be excluded with certainity that a further species inhabits thalli of the same host genus, we assume that it was *L. cosmopolites*, rather than *'Echinothecium reticulatum'*, that was recorded on *Xanthoparmelia* from various European countries (e.g. Diederich et al. 1992, Etayo 1997, Grube 1993, Hafellner 1993, 1994, Keissler 1930, Lettau 1919, 1958, Navarro-Rosines et al. 1994, Nimis & Poelt 1987, Santesson 1993, Vouaux 1912). The true *E. reticulatum*, the ascomata of which are provided with septate seta-like hyphae (see the drawings in Zopf 1898: 246 as well as Navarro-Rosinés & Gomez-Bolea 1989: 64), grows as far as we know exclusively on species of *Parmelia* s. str. (i.e. the *Parmelia saxatilis* group).

Lichenostigma subgen. *Lichenogramma* was described by Navarro-Rosinés and Hafellner (1996), comprising originally only *L. elongata* Nav.-Ros. & Hafellner. The key characters of this subgenus are the oval to elongate ascomata that are connected with superficial pigmented hyphae. *L. elongata* differs from *L. cosmopolites* e.g. by having plurihyphal superficial strands and more elongated ascomata and it is restricted to *Aspicilia* and *Lobothallia* species. The other three known *Lichenostigma* species, *L. usneae* Hafellner, *L. rugosa* Thor, and *L. hyalospora* Kalb & Hafellner lack conspicuous brown superficial vegetative hyphae (Hafellner 1982, Thor 1985, Kalb et al. 1995). *L. usneae* is found on a number of macrolichens, *L. rugosa* grows exclusively on *Diploschistes* species, and *L. hyalospora* is known only from the few Australian collections, with *Haematomma eremaeum* being the host. A few further species of *Lichenostigma* may be hidden among the bunch of *Lichenothelia* species described by Henssen (1987), as some are said to grow on lichens (*Lichenothelia convexa* Henssen pro parte, *L. patagonica* Henssen pro parte, *L. tenuissima* Henssen pro parte), however for none of them a *Xanthoparmelia* is mentioned as host.

Regarding the correct position of *Lichenostigma* in the system of Ascomycotina there is some confusion in the literature. In the most recent edition of the "Dictionary of the Fungi" (Hawksworth et al. 1995: 246) and the "Outline of the Ascomycetes" (Eriksson & Hawksworth 1998) the genus is placed in the Dothideales (Lichenotheliaceae). However the presence of polysaccarides in the ascus wall reactive with Lugol's reagent, that are present in at least some species, support its inclusion in the order Arthoniales.

Distribution: widespread in extratropical regions of both hemispheres (Europe, Asia, Africa, North America, South America, Australia), in temperate regions mainly in the lowlands, in tropical regions only from mid elevations upwards.

Further specimens seen (The numbers in brackets before the date refer to the corresponding numbers in the list of the hosts given above. Collections preserved under the name of the host lichen are indicated by an asterisk* after the number which refers to the host. The names of the authors are abbreviated by their initials):
Europe: **Norway**: Oppland: Vågå, N-Ufer des Sees Vågåvatn ca. 2 km W von Vågåmo, ca. 450 m; S-exponierte Schieferschrofen in einer Triftweide, (2); 29. VIII. 1984, J. H. 11427 & A. Ochsenhofer (GZU). - Oppland: Vågå, ca. 1 km W von Vågåmo; Schieferabbrüche ober der Straße am Nordufer des Sees Vågåvatn, ca. 400 m, (2); 29. VIII. 1984, J. H. 11348 & A. Ochsenhofer (herb. Hafellner). - **Czech Republic**: Bohemia merid., Lomnice n./L., Hráze rybníku, (2*); 24. III. 1886, A. Weidman (GZU). - **Austria**: Niederösterreich: Waldviertel, Ritterkamp 2,5 km N von Rappottenstein, 750 - 800 m, MTB 7456, 7. IV. 1994, J. Poelt & R. Türk (GZU). - Steiermark: [Gurktaler Alpen], bei Murau, Gestüthofbrücke, (17), 29. IV. 1906, B. Fest (GZU). - Steiermark: [Gurktaler Alpen], 2 km NW von Neumarkt, beim Gasthof Vetterl, 900 m, MTB 8952/1, auf niederen phyllitischen Felsblöcken in einer Viehweide, (2*), 13. IX. 1987, W. Obermayer 1874 (GZU). - Steiermark: bei Teufenbach, auf Felsen, (17); 23. VII. 1906, Weisbach (GZU). - Steiermark: Seetaler Alpen, W-Abhang, 1 km E von Perchau, beim Gehöft Pacher, ca. 1140 m, MTB 8852/4, in einer Viehweide, auf Bodensteinen (1*); 20. III. 1987, W. Obermayer 1863 (GZU). - Steiermark: [Seetaler Alpen], bei Neumarkt, auf Felsen, (2); 30. VII. ?, herb. Weisbach (GZU). - Steiermark: [Seetaler Alpen], 4 km E von Scheifling, Feßnach, beim Gehöft Ertl, ca. 1000 m, MTB 8852/4, auf einem Feldblock am Waldrand, (2*); 20. III. 1987, W. Obermayer 1872 (GZU). - Steiermark: Oststeirisches Hügelland, Klöch, S-Hänge N ober der Kirche, ca. 350 m, MTB 9261/2, auf niederen Basaltschrofen, (1); 24. III. 1994, J. H. 41068 & B. Wieser (GZU). - Steiermark: E-exponierte felsige Abbrüche W über der Kirche von Klöch, 330 - 350 m, (1), 20. XI. 1988, leg. J. Poelt (GZU). - Kärnten: zwischen Mühldorf und Möllbrücke, auf einem Gneisblock, (2); 15. II. 1953, W. Kuhnelt (GZU). - Tirol: Osttirol, Hohe Tauern, Virgental, am Eingang ins Dorfertal, S-exponierte Hänge über Hinterbichl, 1350 - 1400 m, (2); 2. VIII. 1986, M. Mayrhofer & H. Mayrhofer (GZU). - Tirol: Osttirol, Hohe Tauern, Virgental, SE- und S-exponierte Kalkschieferfelsen der Burg ca. 500 m W des Ortes Obermauern, 1350 - 1400 m, (2*); 6. IX. 1978, M. Mayrhofer & H. Mayrhofer (GZU). - Tirol: Osttirol, Hohe Tauern, Venediger-Gruppe, Prosseggklamm N von Matrei, ca. 1000 m, 47°01'15"N / 15°32'E, MTB 8941/3; Kalkschiefer, auf besonnten Schieferschrofen, (2), 2. IX. 1998, leg. J. Hafellner no. 46794 (GZU). - **Switzerland**: Kanton Wallis: Saas-Fee, Kapelle zur Hohen Steige, ca. 1750 m, (2*); 7. IX. 1975, P.B. Topham & A.M. Burnet 50 (GZU). - Canton Valais, Gueuroz, along the road between Martigny and Salvan, close to the bridge over Les Gorges du Trient, on gently sloping rock surface, southeastern exposure, ca. 700 m, (2), 16. VII. 1972, leg. M.S. Christiansen no. 72.384 (herb. Hafellner, as an admixture of a specimen of *Stigmidium xanthoparmeliarum*). - Kanton Graubünden: Engadin, Chaschlins bei Susch, um 1440 m, an Gneisfelsen, (17); 31. VIII. 1980, J. Poelt (GZU). - **Italy**: Südtirol: Ötztaler Alpen, Vinschgau, ca. 1 km E von Latsch, 700 - 850 m; S-exponierte Trockenhänge, über Glimmerschiefer, (2); 18. X. 1975, J. H. 41073 (herb. Hafellner). - Ibid., (2), R. Stipacek (GZU). - Südtirol: [Ötztaler Alpen], Vinschgau, Laaser Leiten NW von Laas und Eyrs, ca. 900 m; S-exponierte Trockenrasen mit kleinen Silikatschrofen, auf Blöcken und Schrofen, (1), 5. IX. 1992, J. H. 30593 (GZU). - Südtirol: Ortler Gruppe, am Eingang in das Martelltal bei Morter, ca. 800 m; auf einem Gneisblock, (1); 15. VII. 1962, J. Poelt (GZU). - Südtirol: auf dem Ritten, Unterinn, (2*); 18. VII. 1974, W. Möschl & H. Pittoni (GZU). - Toskanischer Archipel, Insel Elba: Ost-Elba, Fluchtburg Volteraio SE von Bagnaia, Radiolaritfelsen um die Burg,

370 - 394 m, (3*); 29. VIII. 1982, H. Mayrhofer 3889 (GZU). - **France**: Korsika: Dept. Haute-Corse: Umgebung von Corte, Gorges de la Restonica, Forêt de la Restonica, ca. 5 km WSW von Corte, ca. 650 m; Schwarzföhrenwald mit Granitblockwerk, auf Neigungsflächen von Granitblöcken im Halbschatten, (2); 4. IX. 1993, J. H. 31684 (GZU). - Korsika: Dept. Haute-Corse: Golo Tal, ca. 5 km E von Ponte Leccia, S der Eisenbahnbrücke über den Golo Fluß, ca. 170 m; Grünschieferschrofen in einer Macchie, auf SW-exponierten, geneigten Felsplatten, (3); 6. IX. 1993, J. H. 31811 (GZU). - **Spain**: Prov. Zaragoza: Tal des Río Jalón, ca. 3 km NE von Calatayud an der Straße nach Embid de la Riviera, ca. 430 m, SE-exponierte Silikatblockschutthalde mit kleine Schrofen, auf Neigungsflächen von Silikatblöcken, (2); 24. V. 1983, J. H. 17786 (GZU, adest: *Stigmidium xanthoparmeliarum*). - Prov. Tarragona: Sierra de Prades, an der Straße vom Monasterio de Poblet nach Prades kurz ober der Abzweigung nach Vilanova de Prades, ca. 900 m, Quercetum pyrenaicae mit Silikatblöcken, (2); 23. V. 1983, J. H. 17484 (GZU). - Ibid., (2*), J. H. 17510 (GZU). - Prov. Valencia: Castelló, Azuébar, Bnc. Mosquera, U.T.M. 30SYK2417, sobre arenisca, 620 m, (1), 25. X. 1997, V.C. 7983. (VAB).- Prov. Madrid, E von San Martín de Valdeiglesias, kurz W vom Río Alberche, ca. 500 m, S-exponierte Silikatfelsen, (3*); 11. IX. 1980, J. H. 8638 (GZU). – See also under Canary Islands! - **Mazedonia**: Babuna, Paß Pletvar E von Prilep, S-exponierte Hänge mit einzelnen großen Silikatblöcken und Schutt, um 1150 - 1200 m, (2), 11. VII. 1977, J. H. 3910 (GZU, adest: *Nesolechia oxyspora*).

Asia: **Georgia**: Caucasus, distr. Dusheti, in vicinitate pagi Pasanauri, in valle fluminis Belaia Aragva, 1200 - 1500 m, (2); 31. VII. 1982, V. Vasák (GZU). - **Nepal**: Central Himalaya, Langtang area, Palpa SE of Langtang, S of Langtang Khola, ca. 3500 m, low rocks in pasture, (10*); 6. IX. 1986, J. Poelt (GZU). - **Japan**: Honshu: Prov. Hitachi, Ohgata, Tsukuba city, elev. 40 m; on roof tile, (6); 15 II. 1994, H. Kashiwadani & M. Takashiba (separated from Kashiwadani, Lichenes minus cogniti exsiccati 25)(GZU). - Honshu: Prov. Shinano, Kawahake, Minami-Saku-gun, elev. c. 1300 m, on rock, (13); 23. VII. 1972, H. Shibuichi & K. Yoshida (separated from Kurokawa, Lichenes rariores et critici exsiccati 235)(GZU). - Honshu: Prov. Echigo, Pref. Niigata, Takase, Sekikawa-mura, Iwafune-gun, on rocks, (23); 3. X. 1959, M. Togashi (separated from Kashiwadani, Lichenes minus cogniti exsiccati 100)(GZU).

Africa: **Canary Islands**: Tenerife: Macizo de Teno, ca. 1 km W des Ortes Teno Alto, ca. 760 m, 28°20'30"N/16°52'30"W; niedere Lavabreckzienblöcke in einer Weide, (2); 15. II. 1989, J. H. 35895 & A. Hafellner (GZU). - Tenerife: Macizo de Teno, Montana de la Venta ca. 1 km E von Las Casas, ca. 150 m, NE-exponierte Basaltrippe, an Basaltschrofen, (3*); 7. II. 1989, J. H. 35011 & A. Hafellner (GZU). - Tenerife: SW-Abhänge des Teide-Massivs, kurz N oberhalb von Chirche, NE ober Guia de Isora, 28°14'20"N/16°46'W, ca. 1160 m; lockerer Pinus canariensis-Wald über Lavaströmen, (3), 15. XII. 1998, J. H. 46411 (GZU). - Tenerife: Teno-Gebirge, an der Forststraße zwischen Erjos und Las Portelas, 28°20'N/16°49'30"W, ca. 850 m; auf niederen Vulkanitschrofen auf einer Geländerippe im Fayal-Brezal, 17. XII. 1998, (2), J. H. 46406 (GZU). - Tenerife: Teno-Gebirge, Paß zwischen Masca und Carrizal Alto, am Kamm in Richtung Westen, 28°18'30"N/16°51'20"W, 780 - 830 m; Sukkulentenbusch, NW-exponiert auf Blöcken und Schrofen am Grat, (2); 17. XII. 1998, J. H. 46401 (GZU). - El Hierro: Bergrücken S ober dem Mirador de la Peña SW ober dem Ort Guarazoca, ca. 740 m, 27°48'N/17°58'40"W; Weide, auf W-exponierten Abbrüchen der obersten Basaltbänke, (2), 9. II. 1995, J. H. 45589 (GZU). - El Hierro: Punta de Tigirote NE unter dem Ort San Andrés, ca. 840 m, 27°47'10"N/17°55'40"W; markante Felsrippe umgeben von Weideland, auf großen Basaltblöcken am Grat, (2), 10. II. 1995, J. H. 45590 (GZU). - **South Africa**: Transvaal: Pietersburg District, western end of Soutpansberg Mountain above Farm Llewellyn, 23°00S / 29°17'E, 1400 - 1650 m, on acid rock, (11); 13. I. 1986, T.H. Nash (GZU). - Cape Province: about 46 km SW of Swelendam, near the road R316, 34°21'S / 20°9'E, (29), 25. IX. 1987, W. Wetschnig & U. Wetschnig (GZU).

North America: **Canada**: British Columbia: Wells Gray Park, Wells Gray Education and Research Centre, 51°52'N / 120°01'W, ca. 700 m; partly forested farm land, (5); 26. VIII. 1994, T. Goward & J. Poelt (GZU). - Ontario: Cochrane District, Thuderhouse Falls, Scovil Tp., elev. 700 ft.; Jack pine area at top of gorge, (2); VIII. 1976, G.A. Shea (GZU). - **U.S.A.**: Virginia: Shenandoah/Hardy Counties, George Washington National Forest, Wolf Gap campground, oak-hickory woods, (1); 3./6. VI. 1966, R.C. Harris (GZU). - Colorado: Jefferson Co., lower slopes of spurs of The Castle, Bancroft property NW of Wellington Lake, on tors of Pikes Peak granite, (27), 22. VI. 1976, W.A. Weber & M. Klockenbrink (separated from Weber, Lichenes exsiccati 513)(GZU).- Arizona: Coconino Co., Kaibab National Forest, 3.5 km E of Red Butte in mature pinyon-juniper woodland, 35°48'30"N / 112°01'57"W, 1950 m; on soil, (4), 28. VI. 1992, M. Thomas (separated from Nash, Lichenes exsiccati ASU 147)(GZU). - Arizona: Santa Cruz Co., Coronado National Forest, hills just

S of Pena Blanca Lake along state route 289, 3800 ft., on rock, (3*); 30. XII. 1972, T.H. Nash 6102 (GZU). - Arizona: Pima Co., Tuscon Mountains, east base of Contzen Pass, 4.8 km SW of Cortaro, on rhyolite boulders, (25); 12. I. 1973, W.A. Weber & G. Kunkel (separated from Weber, Lichenes exsiccati 415)(GZU). - Arizona: Pima Co., west side of Tuscon Mountains, NW facing slopes, elev. 3000 ft., on volcanic rock, (25*); 29. XII. 1972, leg. T.H. Nash 6197 (GZU). - Arizona: Pinal Co., between Boyce Thompson Arboretum and Picket Post Mountain, 33°16'N / 111°10'W, 700 m, on andesite and rhyolite tuff, (28); 29. XII. 1988, leg. R.S. Egan 13613 (GZU). - California: San Mateo Co., San Bruno Mountains, just SE of San Francisco, 37°41'N / 122°25'30"W, elev. ca. 250 m, (7*); 5. I. 1988, leg. B.D. Ryan 21984 (GZU). - **Mexico**: Estado de Baja California Norte: 10 km N of El Rosario in Cañón del Rosario, 30°08'N / 115°46'W, elev. 90 m, on soil in coastal scrub community, (19); 28. XII. 1990, leg. T.H. Nash (separated from Nash, Lichenes exsiccati ASU 149)(GZU).

South America: **Venezuela**: Estado Merida: Anden, an der Straße Merida - Valera, zwischen San Rafael und Mucuchies, ca. 2950 m, über verbackener Erde an steiler, ca. 2 m hoher Straßenböschung, S- und E-exponiert, (26); 16. IV. 1969, leg. H. Hertel, B. Oberwinkler & F. Oberwinkler (GZU). - **Brazil**: Paraiba, lower 100 m of Pico do Jabre SSW of Patos, 07°16'S / 37°23'W, ca. 850 m, on granite, (22); 18. VI. 1990, leg. T.H. Nash (GZU). - **Uruguay**: Departamento de Lavalleja, 13 km E of Mina and 6 km from route 8 along secondary road to Casadas de Agua del Penitente, 34°21'S / 55°10'W, c. 150 m, on acidic rock, (14); 13. VI. 1989, leg. T.H. Nash (GZU). - **Chile**: without locality data, (24); 1836, leg. Barchay (GZU).

Australia: Australian Capital Territory (A.C.T.): Gudgenby River Gorge, 4.5 km S of Tharwa, 35°34'S / 149°04'E, elev. 620 m, growing on granite rocks in open woodland, (15); 12. IV. 1982, leg. J.A. Elix (separated from Elix, Lichenes australasici exsiccati 19) (GZU). - A.C.T.: Glendale Crossing, 15 km W of Michelago, 35°44'S / 149°00'E, elev. 900 m, growing on granite rocks in open Eucalyptus woodland, (12), 15. III. 1982, leg. J. A. Elix (separated from Elix, Lichenes australasici exsiccati 24)(GZU). - A.C.T.: 8 km W of Canberra, 0.8 km W of Coppins Crossing, 35°15'S/149°03'E, 520 m; over porphyry rocks and onto soil in open grassland, (2); 28. III. 1982, leg. J.A. Elix (GZU). - A.C.T.: Booroomba Rocks, on granite (21); 28. IX. 1983, leg. M. Seaward & J.A. Elix (GZU). - New South Wales: Black Flat, Currowan State Forest, 6 km NW of Nelligen, 35°36'S / 150°05'E, elev. 120 m; growing on mossy granite rocks in wet sclerophyll forest, (8); 2. X. 1982, leg. J.A. Elix (separated from Elix, Lichenes australasici exsiccati 32) (GZU). - New South Wales: Googong Dam Foreshore Reserve, Londonbridge 18 km S of Queanbean, 35°31'S / 149°16'E, on schist, (9*); 26. VII. 1992, leg. H. Mayrhofer 11302 & J.A. Elix (GZU). - New South Wales: Gurrangorambla Range between Cooleman Plain and Tangatara Reservoir, west side of Brindabella Range, ca. 4500 ft., on summit rock outcrops, (21); 17. X. 1967, leg. W.A. Weber (separated from Weber, Lichenes exsiccati 338)(GZU). - Victoria: Bullock Creek, 16 km S of Bendigo along the Calder Highway, 37°52'S / 144°13'E, growing on large granite boulders with a southerly aspect, on creek bank in light shade, in remnant eucalypt woodland, (18); 12. XII. 1983, leg. J. Johnston (separated from Elix, Lichenes australasici exsiccati 63) (GZU). - South Australia: hillside in Torrens Gorge near Castanbul, 16 km NE of Adelaide, 34°52'S / 138°46'E, 160 - 180 m, (12); 12. VIII. 1981, leg. M. Mayrhofer & H. Mayrhofer (GZU). - South Australia: Guthries Steep Gully, 9 km E of Springton, 34°02'S / 139°04'E, 400 m, (16); 12. VIII. 1981, leg. M. Mayrhofer & H. Mayrhofer (GZU). - Western Australia: Lower South West, Meelup NW of Dunsborough, coastal rocks, granite, (10*); 20. VIII. 1988, leg. M., D. & H. Mayrhofer 8533 (GZU).

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CLADOSPORIUM AND CLADOPHIALOPHORA IN CULTURE: DESCRIPTIONS AND AN EXPANDED KEY

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Abstract: Descriptions and a key are provided for 37 species of *Cladosporium*, *Cladophialophora* and *Hormoconis* available in culture collections. Morphology and colony characters are used to separate strains into species or species groups. *Cladosporium macrocarpum* is reclassified as *C. herbarum* var. *macrocarpum*. *Cladophialophora kellermaniana* is considered a synonym of *Cladosporium malorum*. *Cladosporium amoenum* (nomen nudum) is described as *Angungitopsis amoena*, sp. nov.

Intoduction

The genus *Cladosporium* contains some of the most ubiquitous fungi on earth, as well as fungi rarely recorded. There are approximately 500 specific epithets in the genus. Although many are undoubtedly synonyms, there are dozens of species important as pathogens of plants, animals or humans, or which act as destroyers of stored vegetable or manufactured products. *Cladosporium* species are extremely prevalent as saprobes in soil and litter, and on plant surfaces. *Cladosporium* conidia are the most common component of the aerial fungal flora (Al-Doory 1984, Domsch et al. 1980, Farr et al. 1989). Members of *Cladophialophora* are also encountered as environmental isolates, and several are important in clinical settings (Braun and Feiler 1995, de Hoog and Guarro 1995).

In spite of the fact that members of the genus *Cladosporium* are readily isolated from air, soil, litter and a variety of manufactured products, the most comprehensive keys have been constructed largely on the basis of host plant. The most modern and complete keys are those of Ellis (1971, 1976). These two keys, each of which treated a different set of species, covered a total of 39 species, 11 of which were keyed by morphology and the remainder by host or substrate. De Vries (1952) used cultural characters, but keyed only nine species. David (1997) keys 21 species, but the key is confined to fungi previously referred to *Heterosporium*. Other keys are available, but each covers less than half a dozen species (de Hoog and Guarro 1995, Domsch et al. 1980, Samson and van Reenen-Hoekstra 1988, Wang and Zabel 1990). Many other useful publications are available, as discussed here in conjunction with individual descriptions, but these publications do not provide keys.

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Because the number of species keyed by cultural characters is so restricted compared to the number described, there is a need for an expanded culture-based key. We have constructed a key to 37 species, based on strains available at ATCC. Although these strains comprise a small fraction of the total number of names in *Cladosporium* and *Cladophialophora*, the expansion of a cultural key to 37 species increases substantially the number of *Cladosporium* species so treated and we have attempted to include all commonly encountered species. Although *Cladophialophora* is not close to *Cladosporium* phylogenetically (de Hoog et al. 1995, Masclaux et al. 1995, Müller et al. 1987, Untereiner et al. 1995), we have chosen to include several *Cladophialophora* species in the keys, because 1) members of the genus exhibit *Cladosporium*-like morphology, 2) several species were formerly classified in *Cladosporium*, and 3) some recent literature on identification continues to classify such species in *Cladosporium* (Larone 1995, St-Germain and Summerbell 1996).

Materials and Methods

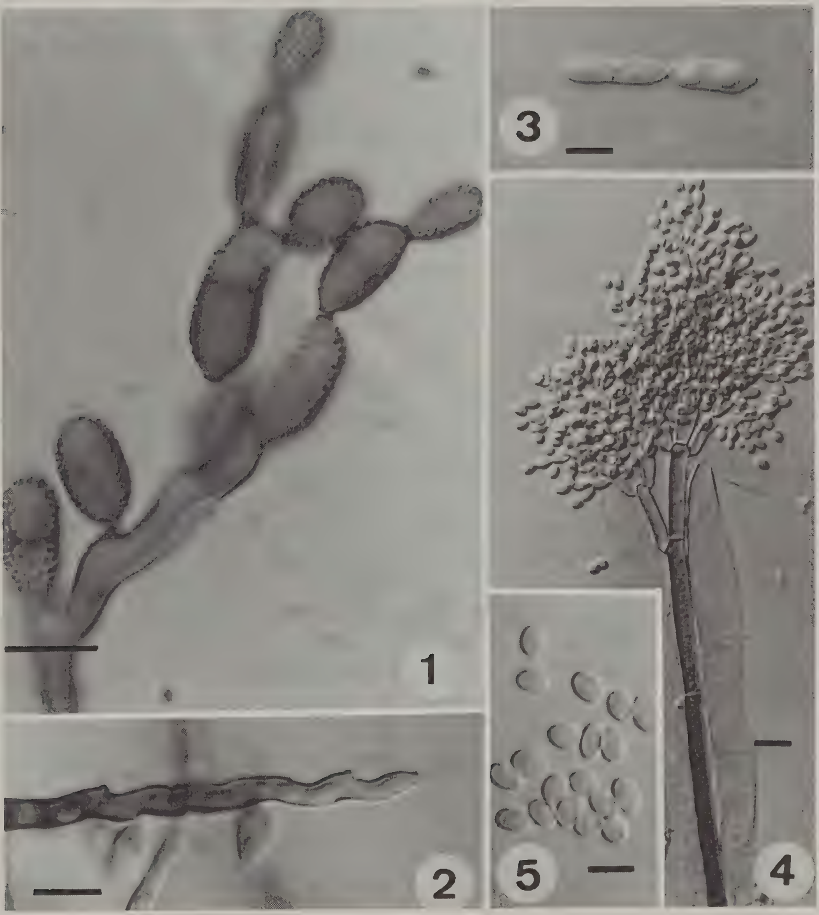
Strains from the ATCC collection were grown on ATCC medium 325 (malt extract agar) slants. Subcultures on plates and slide cultures of medium 325 were incubated in the dark at 25C and growth rates on plates were recorded. Slide cultures were examined and photographed at 100-1000X to record branching patterns of conidial chains and other characters. Plates were examined at 1-33X for diagnostic characters, and pertinent observatons were recorded. If sporulation was poor or absent, strains were transferred to half strength ATCC medium 343 (V8 juice agar) or CLA (carnation leaf agar, Nelson et al. 1983) and incubated under near ultraviolet light on a 12 hr light / 12 hr dark cycle. For each strain, length, width, color, septation, and ornamentation were recorded for 20 conidia and 20 ramoconidia at 1000X, as were the characters of the conidial scars and conidiogenous loci. Length and color were recorded for conidiophores and conidiogenous cells.

Complete records for strains examined are available by searching on ATCC strain number at <http://www.atcc.org>; abbreviated records are provided here.

Descriptions

Cladosporium allii-porri (Sacc. & Briard) Boerema, Meded. -pziektenk. Dienst, Wageningen 152:15, 1977 (1978).
Heterosporium ornithogali Klotzsch var. *allii-porri* Sacc. & Briard, Rev. Mycol. 8: 25, 1886.
Heterosporium allii-porri (Sacc. & Briard) Arx, The Genera of Fungi Sporulating in Pure Culture, p. 305, 1981.

Colonies attaining 30 mm in diameter on malt extract agar at 25C in 2 weeks, olivaceous gray, velutinous; reverse dark olivaceous. Conidiophores mid-olivaceous, semimacronematous to macronematous, straight or slightly flexuous, usually unbranched, intercalary or terminal, deep brown, stout, smooth to verruculose,



Figs. 1-5. 1. *Cladosporium allii-porri* ATCC 200936. Tip of conidiophore and conidia. Bar = 10 µm. 2-3. *Anungitopsis amoena* ("*Cladosporium amoenum*") ATCC 200947. 2. Conidiophore. Bar = 7 µm. 3. Conidia. Bar = 5 µm. 4-5. *Cladosporium breviramosum* ATCC 76215. 4. Conidiophore. Bar = 10 µm. 5. Conidia. Bar = 5 µm.

septate, sometimes geniculate and nodose on the upper portion, up to 295 µm long, usually between 175-235 µm, (4.7-)5.5-6.0(-6.5) µm thick. Conidiogenous cells integrated, terminal, sympodial, with protuberant, dark, cicatrized scars. Conidia solitary or in short branched chains, ovoid, ellipsoid, or oblong with rounded ends, 0-1-(2)-septate, often slightly constricted at septa, verruculose, olivaceous, (8.8-)14.1-17.6(-22.5) µm x (3.8-) 6.1-7.1(-8.8) µm in the broadest part, with a prominent scar at each end (Fig. 1). Hyphae septate, hyaline to olivaceous, smooth to minutely verruculose, 4.4-5.1 µm thick, in slide culture the young hyphal tips swollen.

Strains examined: ATCC no: 200936(CBS 101.81, G.H. Boerema) from *Allium porrum*, Netherlands.

Anungitopsis amoena R.F. Castañeda & F.M. Dugan, sp. nov.
Cladosporium amoenum Castañeda, *nomen nudum.*

A Latin diagnosis is provided:

Coloniae in substratum naturali effusae, pilosae, amphigenae, brunneae. Mycelium plerumque in substrato immersum. Hyphae septatae, ramosae, brunneae, 1.5-2.5 µm diam. Conidiophora conspicua, mononematosa, erecta, recta vel flexuosa, 130-270 x 5-9 µm, cylindrica, sed leviter attenuata et sinuata ad apicem, eramosa, 6-14-septata, levia, brunnea ad basim, pallide brunnea vel subhyalina ad apicem. Cellulae conidiogenae, polyblasticae, sympodiales, primo terminales, tarde terminales et intercalares, leviter sinuatae usque aspecto geniculatae, 10-40 x 3-5 µm, subtiliter cicatricatae interdum vel raro cum loco conidiogeno denticulato, in conidiophoris incorporatae. Conidiorum secessio schizolytica. Conidia ellipsoidea, leniter attenuata ad extremis, blastocatenata, non ramosa, 1-septate, 7-12 x 2-3 µm, interdum leviter constricta ad septo, utrimque truncata et cicatrata, acropleurogena, levia, sicca, pallide brunnea. Teleomorphis ignota.

Substratum: In foliis dejectis *Eucaliptus* sp. in sylvarum pluvarium, La Gran Piedra, Santiago de Cuba, Cuba. Leg. R.F. Castañeda, 2-XI-1994.

Figure 2/3 is here designated as type and ATCC 200947 lot 1315598 as epitype.
Cultures deposited:
INIFAT C94/155 = CBS 254.95 = MUCL 39143 = IMI 367525 = ATCC 200947.

In culture, colonies slow-growing, attaining 14 mm diameter on malt extract agar at 25C in 2 weeks, olivaceous, velutinous; reverse olivaceous black. Conidiophores macronematous, at first pale brown, becoming deep brown, subtended by a hypha also becoming brown, bearing a number of conidial scars in the upper fertile, ligher portion, straight or flexuous (rachis-like), usually simple, rarely branched, intercalary, erect from vegetative hyphae, stout, smooth, septate, gradually tapered toward tip, up to 250 µm high, usually between 99-146 µm, (2.8-)3.2-3.5(-3.8) µm thick, frequently geniculate at the apical fertile portion (Fig. 2). Conidiogenous cells integrated, terminal, sympodial, with cicatrized conidigenous loci. Conidia catenate, forming simple chains, mostly fusiform, sometimes ovoid, olivaceous buff, 0-1-septate, smooth, (6.0-)10.5-12.8(-17.3) µm x (1.5-)2.4-3.0(-3.8) µm in the broadest part, with a prominent, protuberant, dark scar at each end (Fig. 3).

Strains examined: ATCC 200947 = CBS 254.95.

Remarks: The binomial *Cladosporium amoenum* Castañeda has appeared in Untereiner et al. 1998 and the web-based catalog of the Centraalbureau voor Schimmelcultures; material has distributed under that name. The above description is provided for validation under the new name. In contrast to most *Cladosporium* spp., chains of conidia of *A. amoena* branch only infrequently on the natural host, but this difference was not seen in culture.

Cladosporium breviramosum Morgan-Jones, Mycotaxon 32:228, 1988.

Colonies attaining 90 mm in diameter on malt extract agar at 25C in 2 weeks, purplish-gray, thin, powdery; reverse iron gray. Conidiophores micronematous or macronematous, usually simple, intercalary or terminal, septate. Macronematous conidiophores erect, straight or flexuous, cylindrical, verruculose to verrucose or sometimes tuberculate, mid-brown, paler towards the apex, commonly up to 500-600 (800) µm high, but often shorter, between 60-100 µm, not geniculate, bearing one or two lateral, fertile, unicellular metula-like branches subterminally (Fig. 4). Where two branches are present, they originate opposite each other at the same level, immediately below a septum delimiting the terminal cell of the conidiophore. Micronematous conidiophores much more slender, pale olive, smooth; conidiogenous cells holoblastic or polyblastic, terminal, or incorporated in the conidiophore as lateral branches, pale brown to subhyaline at the apex, cylindrical or clavate, with one to three thin terminal or lateral, sessile scars. Conidia in branched chains, ellipsoid, limoniform, subhyaline, aseptate, smooth, (3.8-)4.5-5.3(-6.3) µm long, (2.5-)2.6-2.8(-3.5) um in the broadest part with a small, thin, not easily discernible scar on each end (Fig. 5). Ramoconidia clavate, hyaline, aseptate, (5.0-)7.9-10.8(-16.3) µm x (1.9-)2.3-2.5(-3) µm wide. Hyphae septate, slender, hyaline, smooth, 1.6-2.0 µm thick.

Strains examined: ATCC 64696 (= ATCC 76215) ex-type, wall paper, Georgia, USA, G. Morgan-Jones.

Remarks: Many micronematous conidiophores occur in ATCC 64696. These are thin, slender, smooth, subhyaline, bearing conidial chains at apical fertile portion. They may be the "semimacronematous, subhyaline" conidiophores reported in Morgan-Jones and Jacobsen (1988).

Cladosporium caryigenum (Ellis & Lang.) Gottwald, Mycologia 74(3): 388, 1982.
Fusicladium caryigenum Ellis & Lang. (basionym), J. Mycol. 4:124, 1888.
Fusicladium effusum Winter, J. Mycol. 1:101, 1885.
Fusicladium effusum (Wint.) Demaree var. *carpinum* Ell. & Everh., U.S. Dept. Agric., Agric. Handbok No. 165, p.35, 1889.
Cladosporium effusum Demaree, J. Agric. Res. 37:186, 1928.
non *Cladosporium effusum* Berk. & Curt. Grevillea 3:106, 1875.

Growth of colonies slow, attaining 16 mm in diameter on malt extract agar at 25C in 2 weeks, dark mouse gray to olive brown, velutinous; reverse olivaceous black. Conidiophores semimacronematous or micronematous, light olivaceous, straight, simple, intercalary or terminal, smooth, septate, usually 54-70 µm high, 3.8-4.5 µm wide, not geniculate. Conidiogenous cells terminal, monoblastic. Conidia catenulate, forming simple or branched chains, fusiform with two truncated ends, light olive, 0-(1)-septate, smooth, (16.3-)18.4-20.6(-25.0) µm x (3.1-)4.0-4.5(-4.8) µm in the broadest part, with a prominent, protuberant, dark scar at each end. Ramocondia fusiform, light olive, 0- septate. On slide culture, numerous olivaceous, single celled, intercalary, appressoria-like structures with a light spot in the center formed from hyphae (Fig 6).

Strains examined: ATCC 48375, from pecan, Georgia, USA, T.R. Gottwald; ATCC 58912, pecan, Oklahoma, G.L. Barnes.

Remarks: Gottwald's (1982) multidenticulate ramoconidia and repeated branching of conidial chains of *C. caryigenum* were not observed in these two strains. Ramoconidia only have up to three denticles in ATCC 48375. Branching of chains was seen only once in ATCC 48375. ATCC 58912 did not sporulate, however the hyphal characters and appressoria-like structures were like ATCC 48375. Gottwald did not mention appressoria-like structures. *Cladosporium effusum* is a synonym of *C. caryigenum*. Three cultures named *C. effusum* were studied: ATCC 36950, 12735, and 11320. ATCC 36950 is of questionable identity. It is like *C. sphaerospermum* with subglobose conidia. ATCC 12735 is like ATCC 48375 (*C. caryigenum*): simple conidiophores and dichotomously branched chains of olive conidia. Multidenticulate ramoconidia matching Gottwald's description were scarce. ATCC 11320 also had rarely branching conidial chains and simple conidiophores as in ATCC 48375, and pale, olive, conidial chains, conidiophores and hyphae. However, only ATCC 12735 has appressoria-like structures as found in ATCC 48375, 58912 (*C. caryigenum*). The opinion of Lentz (1953) that the pecan scab fungus should be classified in *Fusicladium* is not currently accepted, but his synopsis of nomenclatural history remains informative.

Cladosporium chlorocephalum (Fres.) Mason & M. B. Ellis, Mycol. Pap. 56: 123-126, 1953.
Periconia chlorocephala Fres. Beitr. Mykol. 1:21, 1850.
Haplographium chlorocephalum (Fres.) Grove, Sci. Gossip. 21:198, 1885.

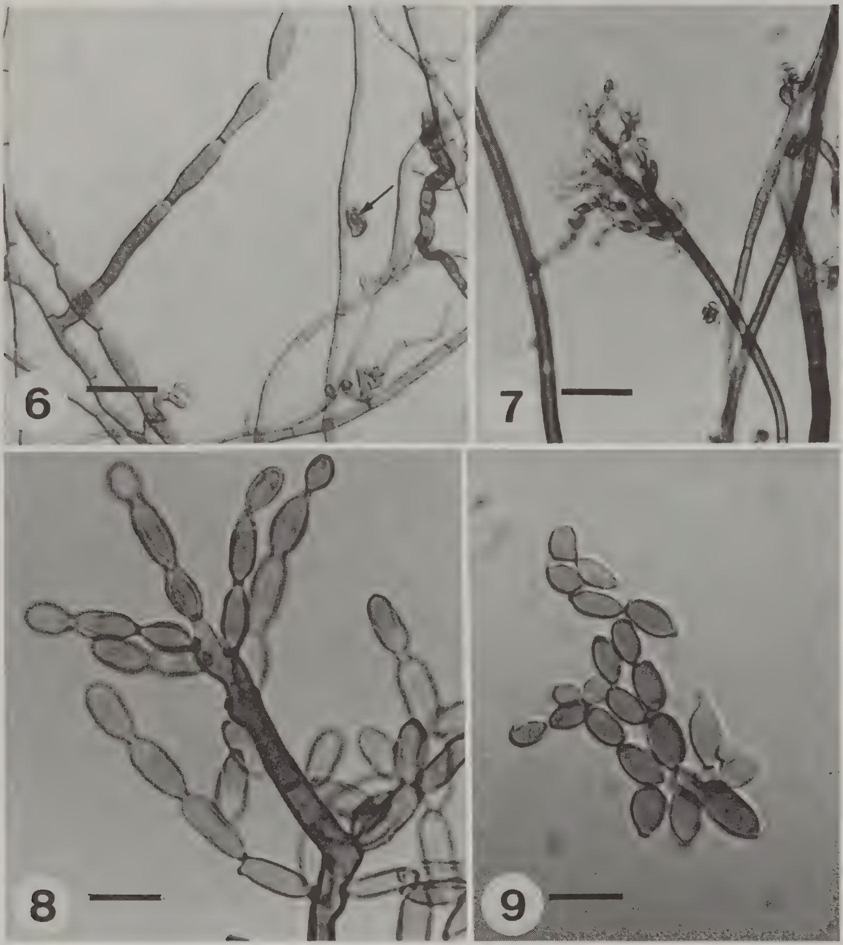
Graphiopsis chlorocephala (Fres.) Trail, Scott. Nat. 10:75, 1889.
Haplographium chlorocephalum (Fres.) Grove var. *ovalisporum* Ferraris, Flora Ital. Crypt. Hyphales:875, 1914.
Cladosporium paeoniae Pass., Justs. Jahresber. 4:235, 1876.
?*Cladosporium paeoniae* Pass. var. *paeoniae anomalae* Sacc., Syll. Fung. 4:351,1886.
Periconia ellipsospora Penz. & Sacc., Atti Ist. Veneto 6, ser. 2:596, 1884.

Colonies attaining 26 mm in diameter on malt extract agar at 25C in 2 weeks, olivaceous, velutinous, powdery; reverse iron gray. Conidiophores semimacronematous or macronematous; not geniculate nor nodose. Where semi-macronematous, straight or flexuous, pale olive, generally thin walled, smooth, up to 500 µm long, septate, branched near top. Where macronematous, erect, straight, rigid to slightly flexuous, thick-walled, septate, dark-brown, paler toward the apex, usually simple, conidiogenous cells terminal, smooth or tuberculate, septate, sometimes up to 150 µm high, usually much shorter but, rarely, up to 500 µm or more, up to 7 µm wide, not geniculate, slightly swollen at apex, with several scars on the tip where ramoconidia arise in compact verticils. Conidia in simple or branched chains, proximal ones ellipsoidal or limoniform, distal ones spherical, light olive, 0-(1)-septate, smooth or finely verruculose, (3.3-)5.8-6.7(-7.5) µm x (1.9-)2.4-2.8(-3.3) µm in the broadest part, with a prominent, protuberant, dark scar at each end. Ramoconidia subglobose to cylindrical, pale olive, 1-2-(4) septate, (7.5-)10.4-14.0(-23.8) µm x (3.1-)3.7-4.1(-5.0) µm wide. Hyphae densely septate, olivaceous brown, smooth.

Strains examined: ATCC 38011, from peony, Japan, T. Yokoyama; ATCC 76306, from peony, Alabama, USA, J.M. McKemy.

Remarks: The verticils of ramoconidia are less *Periconia*-like than those described from plant material, and not all sporulating heads display this character. However, a minority of heads display these whorls of ramoconidia sufficiently distinctly, even sometimes at successive levels, to provide a diagnositic character (Fig. 7). This tendency was described and illustrated by McKemy and Morgan-Jones (1991a), and by Mason and Ellis (1953).

Cladosporium cladosporioides (Fres.) de Vries, Contribution to the knowledge of the genus *Cladosporium* Link ex Fr. p. 57, 1952.
Penicillium cladosporioides Fres., Beitr. Mykol., p. 22, 1863.
Hormodendrum cladosporioides (Fres) Sacc., Michelia 2:148, 1880
Cladosporium hypophyllum Fuckel, Symb. Mycol., p. 356. 1869.
Cladosporium exobasidii Jaap, Verh. Bot. Ver. Prov. Brandenb. 2:29, 1907.
Cladosporium herbarum Link ex Fr. fm. b. *hormodendroides* Ferraris, Flora It. Crypt. 1, fasc. 8, p. 326, 1914.



Figs. 6-9. 6. *Cladosporium caryigenum* ATCC 48375. Conidiophore, conidia and appressorium (arrow). Bar = 20 µm. 7. *Cladosporium chlorocephalum* ATCC 76306. Conidiophore, with ramoconidia arising in whorls. Bar = 20 µm. 8. *Cladosporium cladosporioides* ATCC 200941. Conidiophore and chains of conidia. Bar = 7.5 µm. 9. *Cladosporium cladosporioides* ATCC 201103. Conidia. Bar = 7.5 µm.

Colonies reaching 38 mm in diameter on malt extract agar at 25C in 2 weeks, olivaceous green to olivaceous brown, velvety; reverse greenish black. Conidiophores light olivaceous becoming olivaceous, semimacronematous, macronematous, straight or flexuous, simple or branched, intercalary or terminal, smooth, sometimes verruculose, septate, up to 360 µm high, usually shorter, (2.8-)3.3-4.1(-4.7) µm thick, not geniculate nor nodose, apically truncate with 1-3 denticles, or sympodially denticulate, with scars at conidiogenous loci (Fig. 8). Conidia in heads of densely crowded, profusely branched chains, oblong, limoniform, ellipsoid, or fusiform with truncate ends, light olive, 0-1(2-3)septate, smooth, (5.0-)5.8-6.8(-8.8) µm x (2.5-)2.9-3.1(-3.5) µm in the broadest part with a prominent, protuberant, dark scar at each end (Fig 9). Ramoconidia cylindrical, pale olive, 0-1-(4) septate, (7.5-)10.5-14.4(-22.5) µm, x (2.5-)3.2-3.8(-5.4) µm wide. Hyphae septate, light olivaceous, smooth, 3.1-5.0 µm thick.

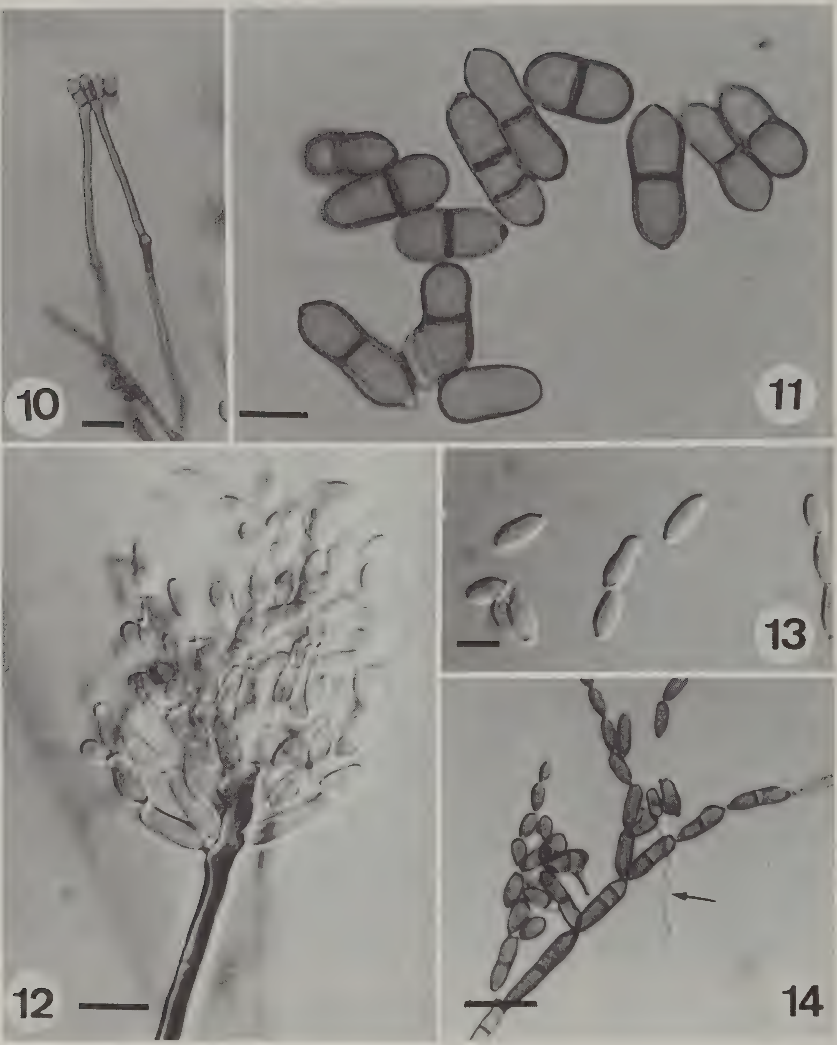
Strains examined: ATCC 66669, from creososte-treated wood, New York, C.J. Wang; ATCC 11277 (CBS 109.21, det. G.A. de Vries), sooty mold on *Hedera helx*, U.K.; ATCC 200941 (CBS 401.80, det. G.A. de Vries), on *Triticum aestivum*, Netherlands; ATCC 201098, 201102, 201103, Bing cherry fruits, Washington state, R.G. Roberts.

Cladosporium colocasiae K. Sawada, 1916, J. Natural Hist. Soc. Taiwan 25:125. 1916. (Predates *Cladosporium colocasiae* K. Sawada 1919.)

Colonies attaining 62 mm in diameter on malt extract agar at 25C in 2 weeks, grayish olive gray, velvety, flocculose; reverse iron gray. Conidiophores deep brown, macronematous, thick walled, straight or flexuous, simple, intercalary or terminal, smooth, septate, up to 675 µm high, (2.8)3.5-5.3(-11.8) µm thick, geniculate and with up to 4 nodes; nodes 4.8-6.9 µm wide with up to 4 scars. Conidiogenous cells integrated, terminal, monoblastic. Conidia arising from terminal swellings (which later become intercalary), in simple or branched chains, ellipsoid to oblong with two rounded ends, mid-olivaceous, 0-1-(3)-septate, smooth, usually constricted at the septa, with a prominent, slightly pointed protuberant, dark scar at each end (Fig. 11). Conidia with 1-2 scars measured (12.5-)14.9-17.0(-21.3) µm x (4.1-)6.1-6.6(-7.5) µm in the broadest part. Conidia with more than two scars oblong, 0-2 septate. Hyphae septate, pale to olivaceous, smooth to finely roughened.

Strains examined: ATCC 76307, from *Colocasia esculenta* (taro), Louisiana, G.E. Holcomb; ATCC 38014, from *Colocasia esculenta*, Japan, T. Yokoyama; ATCC 200944, from *Colocasia esculenta*, Taiwan, K. Kurata.

Remarks: In Matsushima (1975), conidiophores have 4 to 10 nodes. However, only up to 4 nodes per conidiophore were observed in these studies.



Figs 10-14. 10-11.. *Cladosporium colocasiae* ATCC 38014. 10. Conidiophores. Bar = 20 µm. 11. Conidia. Bar = 7.5 µm. 12-13. *Cladosporium coralloides* ATCC 16160. 12. Conidiophore and conidia. Bar = 7.5 µm. 13. Conidia. Bar = 5 µm. 14. *Cladosporium cucumerinum* ATCC 11279. Conidia and spiral hypha (arrow) Bar = 20 µm.

Cladosporium coralloides W. Yamamoto, Sci. Rep. Hyogo Univ. Agric., Ser. Agric. Biol. 4(1): 5, 1959. (Nom. inval., Art. 37.1.)

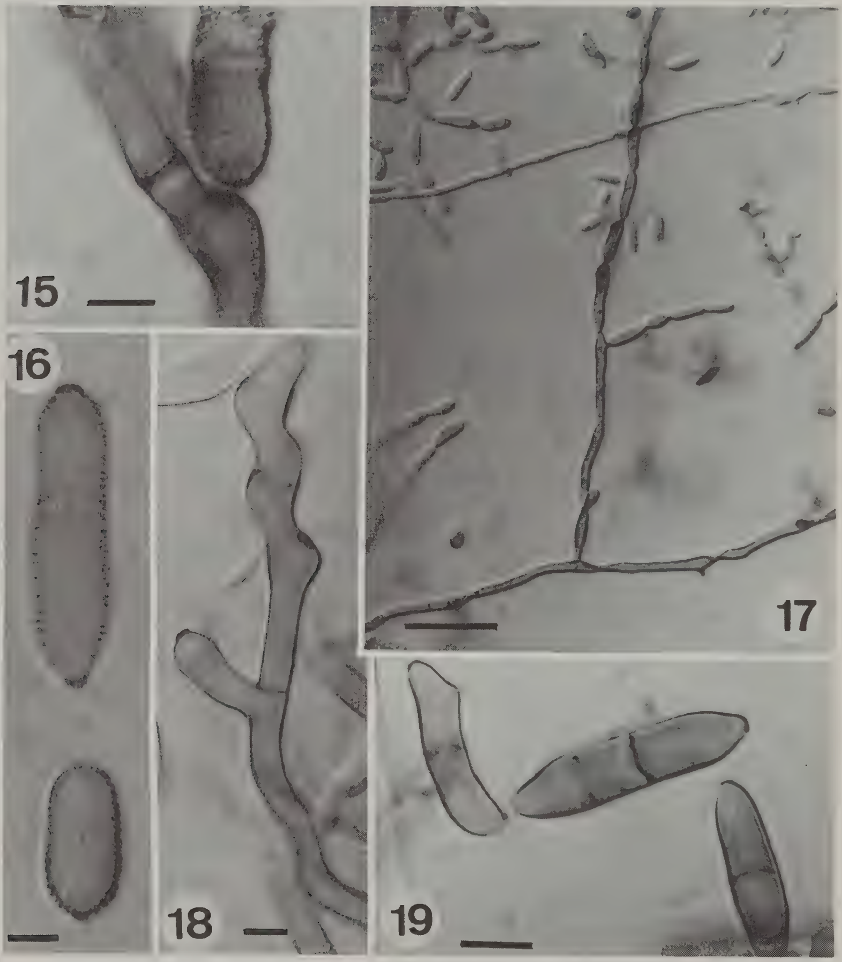
Colonies attaining 81 mm in diameter on malt extract agar at 25C in 2 weeks, gray olivaceous, powdery, velutinous; reverse olivaceous black. Conidiophores light olivaceous becoming olivaceous, thick walled, macronematous, straight or flexuous, usually simple, sometimes branched, intercalary or terminal, smooth, septate, up to 470 μm high, usually much shorter, 27-47 μm, (2.4-)3.0-3.5(-4.4) μm wide, not geniculate, apical portion with dark often protruding cicatrized scars, sometimes proliferating in a flexuous to sympodial manner (Fig. 12). Conidiogenous cells integrated, terminal. Conidia forming branched chains; those with l-2 scars ellipsoid, limoniform, sometimes fusiform, light olive, 0-septate, smooth, (4.4-)5.4-6.0(-7.5) μm long, (1.9-)2.4-2.7(-2.9) μm in the broadest part with a prominent, protuberant, dark scar at each end. Ramoconidia subglobose to cylindrical, pale olive, 0-(1) septate, (8.8-)14.7-22.1(-27.5) μm x (2.4-)2.8-3.2(-4.4) μm wide (Fig. 13). Hyphae septate, olivaceous brown, smooth, 3.0-3.7 μm thick.

Strain examined: ATCC 16160, from *Ficus carica*, Japan.

Remarks: Apparently Yamamoto did not designate a type. ATCC 16160 is from one of the same two hosts documented in the original description and was deposited as IFO 6536 by the Hyogo University of Agriculture, the institution publishing Yamamoto's description. Accordingly, Figure 12/13 from lyophilized batch 6-6-67 archival stock (AS) is designated as lectotype and the lyophilized material as epitype.

Cladosporium cucumerinum Ellis & Arth., Bull. agr. Exp. Stn. Indiana 19:9, 1889.

Colonies attaining 74 mm in diameter on malt extract agar at 25C in 2 weeks, pale olivaceous gray to olivaceous gray, flocculose; reverse greenish black. Conidiophores light olivaceous to mid olivaceous, micronematous and semimacronematous, straight, usually simple, intercalary or terminal, stout, smooth, septate, up to 440 μm high, (2.5-)2.3-4.0(-5.0) μm thick, not geniculate and nodose, apically truncated. Conidia forming branched long chains on top of conidiohores, limoniform, fusiform, oblong, light olive, 0-(1)-septate, smooth, with a prominent, protuberant, dark scar at each end (Fig. 14). Conidia with 1-2 scars measured (6.9-)9.2-11.6(-15.6) μm x (3.0-)3.4-3.7(-4.4) μm. Conidia with more than two scars ellipsoid, fusiform, pale olive, 0-1-(4) septate, (10.0-)13.9-18.8(-19.5) x (3.8-)4.0-5.0 μm. Hyphae subhyaline becoming olive, septate, smooth, young hyphae helically coiled when viewed at 30X.



Figs. 15-19. 15-16. *Cladosporium echinulatum* ATCC 56129. 15. Flexuous, nodose conidiophore. Bar = 7.5 µm. 16. Conidia. top: septate. bottom: aseptate. Bar = 5 µm. 17. *Cladosporium elatum* ATCC 11289. Conidiophore and conidia. Bar = 25 µm. 18-19. *Cladosporium fulvum* ATCC 44962. 18. Conidiophore. Bar = 5 µm. 19. Conidia. Bar = 7.5 µm.

Strains examined: ATCC 11279 (CBS 158.51, det. G.A. de Vries), from *Cucumis sativus*, Netherlands; ATCC 16402, from *Cucrubita pepo*, North Carolina, D.S. Strider; ATCC 26211, from *Cucumis sativa*, J. Dekker; ATCC 38727, A. Fuchs.

Remarks: The slime coat appearing on submerged hyphae which was observed by de Vries (1952) was not observed here.

Cladosporium echinulatum (Berk) de Vries, Contribution to the knowledge of the genus *Cladosporium* Link ex Fr., Baarn, p 49, 1952.
Heterosporium echinulatum (Berk.) Cooke, Grevillea 5:123, 1877.
For other synonyms see David (1997).

Colonies attaining 23 mm in diameter on malt extract agar at 25C in 2 weeks, dark gray olivaceous, flocculose; reverse iron gray. Conidiophores light to mid-olivaceous, semimacronematous to macronematous, distinct, straight or flexuous, nodose, usually simple, intercalary or terminal, stout, smooth, septate, geniculate, (4.4-)5.4-6.1(-6.9) µm wide. Conidiogenous cells integrated, terminal, flexuous to sympodial; conidiogenous loci cicatrized, with protuberant dark scars (Fig. 15). Conidia solitary or in short unbranched chains, oblong, ellipsoid, with rounded ends, straight or slightly curved, 0-2-(3)-septate, slightly constricted at septa, verruculose, pale olive, (16.9-)22.9-26.7(-30.6) µm x (6.0-)7.7-8.6(-9.8) µm, with a prominent, protuberant, dark scar at each end (Fig. 16). Hyphae septate, hyaline to olivaceous, smooth, 4.7-5.7 µm thick.

Strains examined: ATCC 56129, from *Dianthus caryophyllus*, Portugal, M.C. Lopes.

Remarks: The number of septa in this strain, 0-2-(3), is less than that in Ellis (1971), 1-5-(commonly 2-4); and conidia are smaller than those described by Ellis (1971).

Cladosporium elatum (Harz) Nannfeldt, Sven. Skogsvardsfoeren. Tidskr. 32:397, 1934.
Hormodendron elatum Harz, Bull. Soc. Imp. Nat. Moscou 44(1):140, 1871.

Colonies attaining 49 mm in diameter on malt extract agar at 25C in 2 weeks, grayish olivaceous, powdery; reverse greenish black. Conidiophores not well differentiated, cells narrower at septa, usually branched, light olivaceous to olivaceous, straight or flexuous, smooth, septate, up to 390 µm long, usually 140-260 µm, (2.3-)3.1-4.2 (-5.4) µm wide, not geniculate nor nodose, often intergrading into chains of elongated, sinuate conidia. Conidia in very long, branched chains, subglobose, limoniform to fusiform to sinuate, light olive to olive, 0-(1)-septate, smooth, conidial scars are not or hardly darker than the conidial bodies, with protuberant scar at each end (Fig. 17). Conidia with less than two scars measured (6.9-)11.4-14.7(-25.0) µm x (1.4-)3.4-3.8(-6.0) µm. Conidia with more than two scars cylindrical, pale olive, 0-(1) septate, with branch points often conspicuously protuberant to denticulate, (7.5-)12- 15.6(-20.6) µm x (2.5-)3.2-3.6(-4.4) µm. Hyphae septate, olivaceous brown, smooth, 2.4-2.9 µm thick.

Strain examined: ATCC 11280, from wood pulp, Sweden, E. Melin.

Remarks: Thick-walled, brown chlamydospores mentioned by Ellis (1976) were not found in this culture. However, germinating conidia usually swell into a globose shape. *C. elatum* has a morphology similar to species of *Cladophialophora*: well differentiated conidiophores are absent and the conidial scars are not or barely darker than the conidial bodies. This species should not be maintained in *Cladosporium*. However, nutritional tests can differentiate it from *Cladophialophora* (de Hoog et al., 1995). Thus the taxonomic position remains to be determined.

Cladosporium fulvum Cooke, Grevillea 12:32. 1883.
Fulvia fulva (Cooke) Ciferri, Atti Ist. Bot. Univ. Lab. Crittoga. Pavia, Serie 5, 10(1):246, 1954.

Colonies slow growing, attaining 10 mm in diameter on malt extract agar at 25C in 2 weeks, gray olivaceous, felty, turning to purplish; reverse blackish. Conidiophores very pale olivaceous, semimacronematous, straight or flexuous, usually branched, narrow at the base, thickening towards the apex, sometimes with unilateral nodose swellings which may proliferate as short lateral branchlets, intercalary or terminal, smooth, septate, up to 115 µm high, usually much shorter, 30-63 um, (1.8)-2.3-2.8(-3.0) µm thick, not geniculate nor nodose (Fig. 18). Conidia forming branched chains, cylindrical, ellipsoid, straight to conspicuoulsy sinuate, light olive to olive, 0-1-(3) septate, smooth, with a conspicuous dark scar at each end (Fig. 19). Conidia with one or two scars measured (11.8-)18.2-23.4(-28.8) µm x (3.3-)4.8-5.5(-6.3) µm. Ramoconidia 0-3 septate, (18.8-)23.2-29.2(-39.4) µm x (3.3-)4.3-5.1(-6.3) µm wide. Hyphae septate, hyaline to pale olive, smooth, 2.2-2.5 µm thick.

Strains examined: ATCC 44960, 44962, from tomato, Netherlands, M. Gerlach.

Remarks: Unilateral nodose swelling may proliferate as short lateral branchlets. However, the unilateral swellings are not as conspicuous as described in Ellis (1976).

Cladosporium gossypiicola Pidoplichko & Deniak, [as '*gossypicola*'] in Pidoplichko, Fungus flora of coarse fodders, p. 272, 1953.

Colonies attaining 62 mm in diameter on malt extract agar at 25C in 2 weeks, olivaceous, powdery, velvety; reverse greenish black. Conidiophores light olivaceous to olivaceous, semimacronematous, macronematous, straight or flexuous, usually simple, sometimes branched, intercalary or terminal, smooth, septate, usually up to 90 µm long but as long as 250-400 µm, (3.8-)4.4-5.3(-6.3) µm wide, not geniculate nor nodose, apically truncated. Conidia forming branched chains at apices of conidiophores, limoniform, oval or ellipsoid, light olive, 0-septate, smooth, minutely verruculose, with a prominent, protuberant, dark scar at each end. Conidia with 1-2 scars measured (3.1-)4.9-6.2(-10.0) µm x (1.9-)2.7-3.1(-3.5) µm (Fig. 20). Condia with more than two scars subglobose to cylindrical, pale olive, 0-(1)- septate, (7.5-)9.4-12.0(-18.8) µm x (3.1-)3.6-4.0(-5.5) µm. Hyphae septate, light olivaceous, smooth, 2.2-2.6 µm wide.

Strain examined: ATCC 38026, from *Gossypium* seed, Israel, H. Gonen.

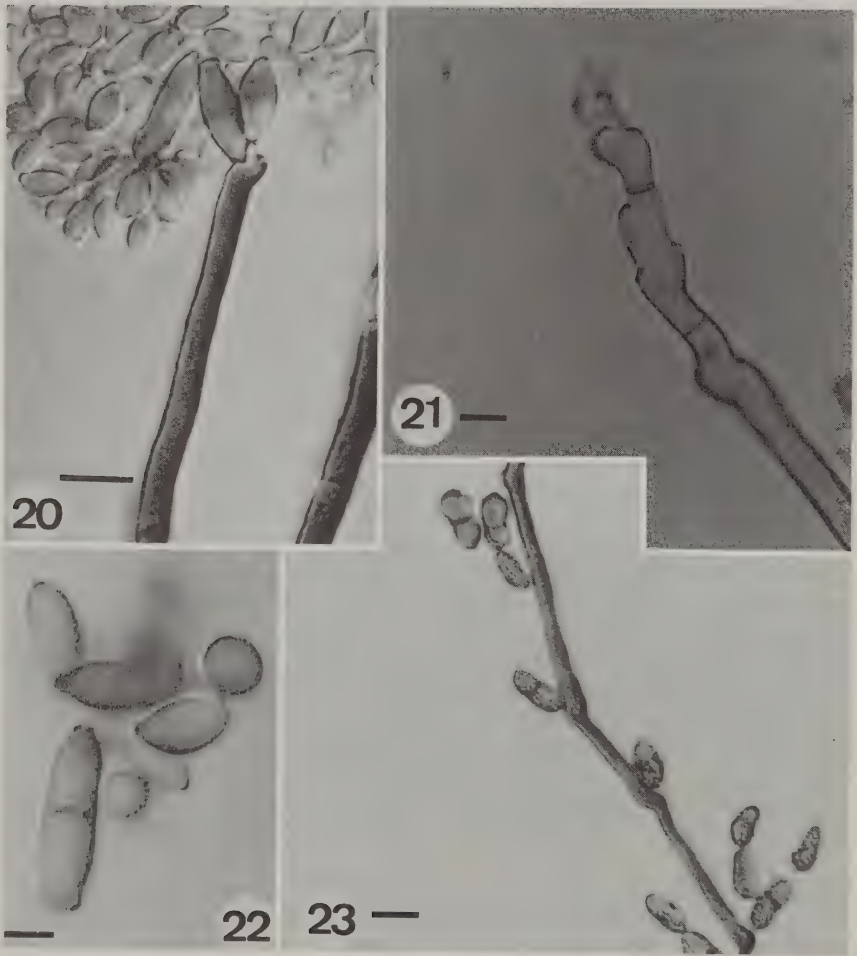
Remarks: Reclassified as *Cladosporium tenuissimum* by CBS (CBS 674.82) but differing from that species here by shorter conidiophores.

Cladosporium herbarum (Pers.: Fr.) Link, Mag. Ges. Naturf. Freunde, Berlin, 7:37, 1815.
Dematium herbarum Pers., Syn. Meth. Fung., p. 699, 1801.
For further synonyms, see Hughes (1958).
Teleomorph:
Mycosphaerella tassiana (de Not.) Johanson, Öfvers. Förh. Kongl. Svenska Vetensk.-Akad. 41(9):167, 1884.
For furher synonyms for the teleomorph, see Corlett (1991).

Colonies on malt extract agar at 25C are 45 mm in diameter in 2 weeks, olivaceous-green to olivaceous brown, velvety, slightly flocculose; reverse iron gray. Conidiophores light olivaceous to olivaceous brown, distinct, micronematous to (usually) macronematous, straight or flexuous, branched or unbranched, intercalary or terminal, smooth to verrucolose, septate, geniculate and nodose on the upper portion, up to 285 µm long, 3.8-4.5 µm wide (Fig. 21). Conidiogenous cells integrated, terminal, sympodial, cicatrized, with 1-4 dark scars on the nodes. Conidia forming branched chains, ovoid, ellipsoid, limoniform or fusiform, 0-(1-(2))-septate, verruculose, light olivaceous, (6.3-)10.8-13.9(-22.0) µm x (2.5)5.0-6.0(-7.5) µm; ramoconidia oblong, ellipsoidal, clavate, verruculose, light olivaceous, with prominent, protuberant, dark scars, (7.5-)14.4-17.8(-37) µm x (2.5-)5.3-6.1(-6.3) µm, 0-(1-(2)) septate, with a prominent, protuberant, dark scar at one or each end (Fig. 22). Hyphae septate, hyaline to olivaceous, smooth to minutely verruculose, 3.8-4.5 µm wide.

Strains examined: ATCC 66670, from preservative-treated wood, New York, C.J. Wang; ATCC 201090, 201091, 201093, 201094, from Bing cherry fruits, Washington state, R.G. Roberts.

Remarks: When cultured on 1/2 V8 agar, at 25C, conidiophores are densely nodose near the apical portion. Most descriptions showed that the conidiophores are smooth walled, however, in this study several strains exhibited smooth and roughened conidiophores (ATCC 201091, 201093, 201094). McKemy and Morgan-Jones (1991c) obtained *in vitro* greater maximum conidiophore lengths than obtained in this study.



Figs. 20-23. 20. *Cladosporium gossypiicola* ATCC 38026. Conidiophore and conidia. Bar = 7.5 µm. 21-22. *Cladosporium herbarum* ATCC 201090. 21. Conidiophore. Bar = 5 µm. 22. Conidia. Bar = 5 µm. 23. *Cladosporium herbarum* var. *macrocarpum* ATCC 201097. Bar = 10 µm.

Cladosporium herbarum (Pers.) Link var. **macrocarpum** M/H.-M.Ho &
F.M.Dugan, *comb. nov.*
Cladosporium macrocarpum Preuss, Sturm's Deut. Fl. (Preuss) 3, p.27- 28, 1848.

Colonies on malt extract agar at 25C variable, 29-70 mm in diameter in 2 weeks, olivaceous-green, velutinous to floccose; reverse deep, blackish green. Conidiophores light olivaceous to olivaceous brown, distinct, micronematous to (usually) macronematous, straight or flexuous, branched or unbranched, intercalary or terminal, smooth to verruculose, septate, geniculate and nodose on the upper portion, up to approximately 200 µm high (very rarely 500 µm high), 4-5 µm wide. Conidiogenous cells integrated, terminal, sympodial, cicatrized, with 1-4 dark scars on the nodes. Conidia forming branched chains, ovoid, ellipsoid, limoniform or fusiform, 0-1(2)-septate, verruculose, light olivaceous, with a prominent, protuberant, dark scar at one or each end, (8-)12-18(-24) µm long, (4-)5-8(-9.8) µm in the broadest part (Fig. 23); ramoconidia oblong, ellipsoidal, ovoid to clavate, verruculose, light olivaceous, with prominent, protuberant, dark scars, commonly17-24 µm long, 7-11 µm wide , 0-1(-2) septate. Hyphae septate, hyaline to olivaceous, smooth to minutely verruculose, 4-5 µm thick. Differing from *C. herbarum* chiefly by larger and more frequently septate conidia.

Strains examined: ATCC 201097, 201099, from Bing cherry fruits, Washington state, R.G. Roberts.

Remarks: A morphological continuum has been demonstrated between *C. macrocarpum* and *C. herbarum* (Dugan and Roberts, 1994). A considerable number of other varieties have been described for *C. herbarum* (Prasil and de Hoog, 1988). For a differing opinion on *C. macrocarpum*, and for synonyms, see David (1997).

Cladosporium laxicapitulatum Matsushima, Icones Microfungorum a Matsushima Lectorum p.35, 1975.

Colonies attaining 74 mm in diameter on malt extract agar at 25C in 2 weeks, olivaceous brown, powdery, velvety; reverse iron gray. Conidiophores macronematous, greenish brown, straight, erect, simple, intercalary or terminal, smooth or verruculose, septate, up to 365 mm high, usually much shorter, about 70-145 µm, (2.3-)3.0-3.3(-3.8) µm wide, not geniculate nor nodose, with 2-4 protruding scars at the apex, and occasionally proliferating for a short distance in flexuous or semi-sympodial manner (Fig. 24). Conidia in branched chains, those with two or fewer scars limoniform, ellipsoid, greenish brown, 0-septate, smooth, (4.0-)5.5-6.5(-7.5) µm x 2.8-3.1(-3.5) µm, with 1-2 prominent, protuberant, dark scars (Fig. 25). Ramoconidia with more than two scars cylindrical, greenish olive, 0-1-(4) septate, (7.5-)8.9-10.4(-12.5) µm x (3.0-)3.1-3.5(-4.0) µm. Hyphae septate, light greenish brown, smooth to verruculose, 2.9-3.8 µm wide, often toruloid.

Strain examined: ATCC 200945 (CBS 464.82, det. G.S. de Hoog), from *Alnus glutinosa*, Netherlands.

Cladosporium lignicola Corda, Icon. Fung. I: 14, 1837.

Colonies attaining 45 mm in diameter on malt extract agar at 25C in 2 weeks, olivaceous, powdery, velvety; reverse olivaceous gray. Conidiophores light olivaceous, micronematous, straight or flexuous, simple or branched, intercalary or terminal, smooth, septate, 3.5-4.0 mm widely, neither geniculate nor nodose, without extended apical proliferation, producing a nearly truncate top with several distinctly protruding hila (Fig. 26). Conidia in branched chains, subglobose, limoniform, ellipsoid, oblong, light olive, 0-(1)-septate, smooth, with a prominent, protuberant, dark scar at each end, often with a beak on distal end (Fig. 27). Conidia with 1-2 scars measured (4.4-)6.4-8.3(-11.3) µm x (3.5-)3.9-4.2(-5.0) µm, length becoming shorter toward chain apex. Ramoconidia alternarioid, obclavate, pale olive, 0-1-septate, (10.0-)15.4-19.0(-24.4) µm x (2.8-)3.5-4.0(-5.00) µm. Hyphae septate, light olivaceous, verruculose, 3.0-3.7 µm wide.

Strain studied: ATCC 38493, U.S. Patent 4,086,268.

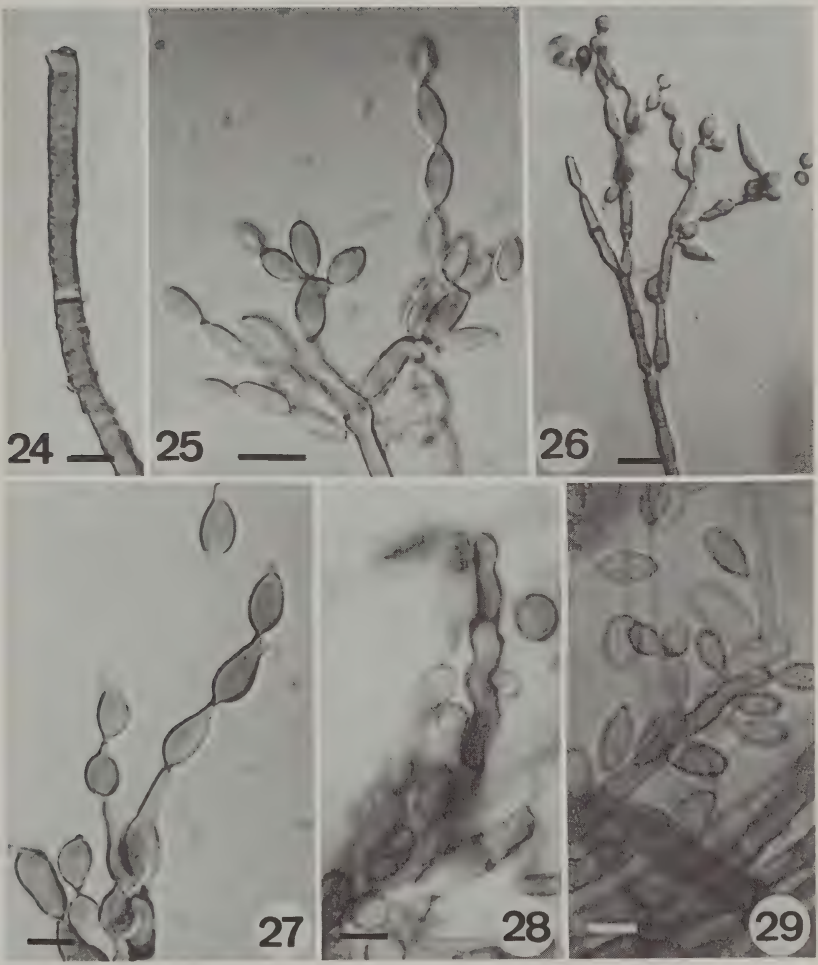
Remarks: The beak-like protrusion of conidia scars and *Alternaria*-like ramoconidia are distinctive characteristics of this species.

Cladosporium magnusianum (Jaap) M. B. Ellis, More Dematiaceous Hyphomycetes, p. 337, 1976.
Heterosporium magnusianum Jaap, Schr. Naturwiss. Ver. Schlesw.-Holst. 12:346, 1902.

Colonies attaining 55 mm in diameter on malt extract agar at 25C in 2 weeks, velutinous, slightly flocculose, olivaceous brown; reverse greenish black. Conidiophores light olivaceous to dark brown, sometimes walls becoming thick, distinct, straight or flexuous, usually unbranched, intercalary or terminal, stout, smooth, septate, geniculate on the upper portion, up to 270 µm long, usually 95-145 µm, (2.5-)3.0-3.7(-5.0) µm wide (Figs. 28, 29). Conidiogenous cells integrated, terminal, sometimes proliferating sympodially for up to approximately 45 mm, with cicatrized, protuberant dark scars toward the apex. Conidia solitary or forming short branched chains, ovoid, oblong, limoniform, or fusiform, 0-(1-(2))-septate, verruculose, golden brown, (6.3-)8.9-11.6(-16.3) µm x (3.1-)4.2-4.8(-5.3) µm, with a prominent, protuberant, dark scar at each end. Ramoconidia cylindrical, mostly one celled, sometimes with one septum, golden brown, (8.8-)15.0-18.8(-23.1) µm x (3.1-)4.5-5.1(-6.9) µm. Hyphae septate, hyaline to olivaceous, smooth to minutely verruculose, 2.7-3.4 µm thick.

Strain examined: ATCC 200946, from *Narthecium ossifragum*, Norway, M. di Menna.

Remarks: Most of the conidia are 1(2)- celled; old conidia which have germinated can be seen with up to 5 cells. This differs from Ellis (1976), who described the conidia as 1-6 septate on the basis of herbarium material.



Figs. 24-29. 24-25. *Cladosporium laxicapitulatum* ATCC 200945. 24. Conidiophore. Bar =5 µm. 25. Conidiophore apex and conidia. Bar = 7.5 µm. 26-27. *Cladosporium lignicola* ATCC 38493. 26. Conidiophore and conidia. Bar = 10 µm. 27. Alternarioid conidia. Bar = 5 µm. 28-29. *Cladosporium magnusianum* ATCC 200946. 28. Conidiophore. Bar = 5 µm. 29. Conidiophore and conidia. Bar = 5 µm.

Cladosporium malorum Ruehle, Phytopathology 21:1146, 1931.
Cladosporium porophorum Matsushima, Icones microfungorum a Matsushima lectorum, Kobe, p.36, 1975.
Cladophialophora kellermaniana (Marasas & Bredell) Braun & Feiler, Microbiol. Res. 150:83, 1995.
Phaeoramularia kellermaniana Marasas & Bredell, Bothelia 11:217, 1974.

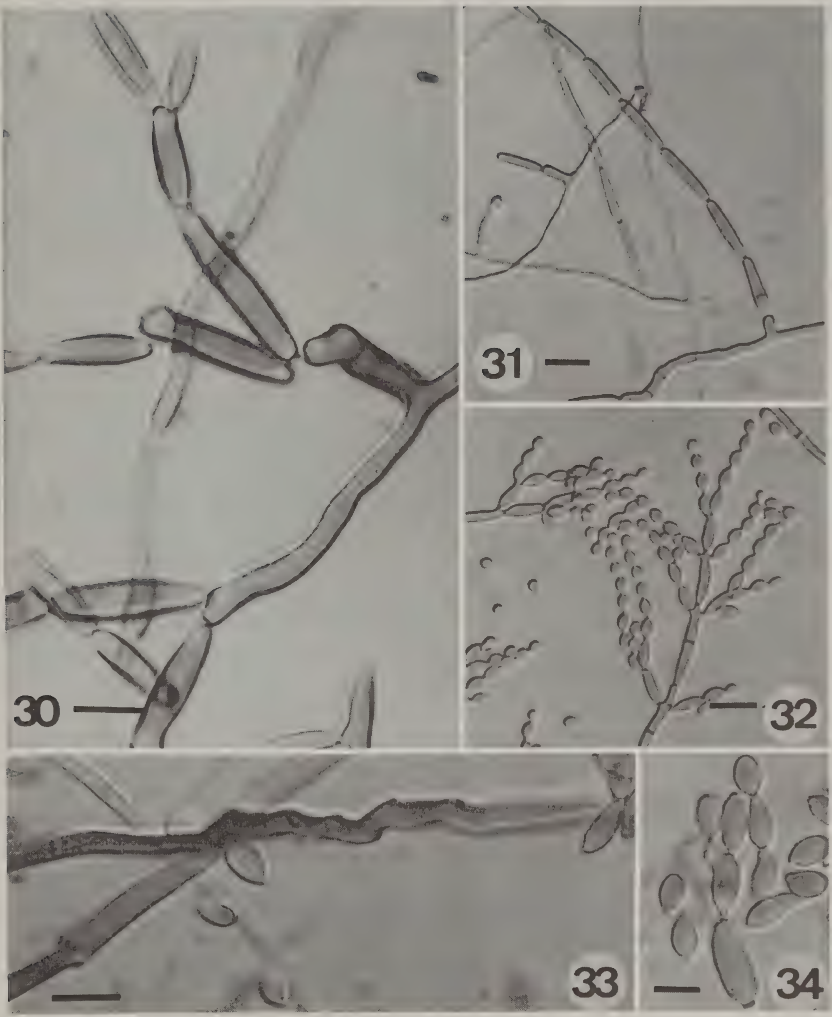
Colonies attaining 90 mm in diameter on malt extract agar at 25C in 11-14 days, olivaceous gray to deep olive green, flocculose to felty, reverse olivaceous to blackish olive. Conidiophores light olivaceous to mid-olivaceous, straight or flexuous, simple to reduced, intercalary, smooth, short, 0-3 septate, up to 35 µm long, usually between 9.0-16.0 µm, (1.9-)2.2-2.8(-3.8) µm wide, conidiogenous loci cicatrized (Figs. 30, 31). Conidiogenous cells integrated, usually terminal, monoblastic. Conidia forming long branching chains, oblong, olivaceous buff to light olive, 0-1(-2)septate, smooth, with a dark scar at each end. Conidia with ≤ 2 scars measured (6.0-)8.0-12.0(-17.0) µm x (2.0-)2.4-3.0(-4.0) µm. Ramoconidia oblong, pale olive, 0-(1-2)septate, up to 25 µm x 5 µm. Chlamydospores sometimes present. Hyphae septate, pale olivaceous, smooth, 2.0-2.4 µm wide.

Strains examined: *Cladosporium malorum* ATCC 36953, from fruit of *Pyrus malus*, Washington state, F.D. Heald; ATCC 38025, from grass litter, Saskatchewan, B.C. Bhatt; ATCC 96020, from Bing cherry fruit, Washington state, R.G. Roberts; *Cladosporium porophorum* ATCC 200938 (CBS 900.87, det. G.S. de Hoog), soil, Lebanon; ATCC 200939 (CBS 173.80, det. G.S. de Hoog), agricultural soil, Syria; *Cladophialophora kellermaniana* ATCC 28332, wheat stubble, South Africa, (ex-type).

Remarks: *Cladophialophora kellermaniana* differs from most strains of *Cladosporium malorum* only in having slightly more reduced conidiophores and slightly larger conidia. The synonymy of *Cladosporium porophorum* with *C. malorum* has been previously documented (Dugan et al. 1995). *Cladosporium malorum* is here maintained in *Cladosporium* because the conidial scars are conspicuous.

Cladosporium minourae Iwatsu, Mycotaxon 20:523, 1984.

Colonies attaining 22 mm in diameter on malt extract agar at 25C in 2 weeks, grayish olivaceous black, powdery, velvety; reverse olivaceous black. Conidiophores pale olivaceous, semimacronematous, micronematous, straight or flexuous, simple or branched, intercalary or terminal, smooth, septate, constricted at base, (2.1-)2.5-2.8(-3.1) µm wide, not geniculate nor nodose (Fig. 32). Conidia formed in frequently branched chains of up to 16 conidia per chain, mostly limoniform, or ellipsoid to cylindrical when borne at the base of chains, light olive, smooth, with a prominent, protuberant, scar at each end. Conidia with 1-2 scars 0-septate, (4.4-)5.4-6.5(-8.0)



Figs. 30-34. 30-31. *Cladosporium malorum*. 30. ATCC 96020. Conidiophores and conidia. Bar = 7.5 µm. 31. ATCC 200939. Conidiophores and conidia. Bar = 10 µm. 32. *Cladosporium minourae* ATCC 56961. Conidiophores and conidia. Bar = 10 µm. 33-34. *Cladosporium multigeniculatum* ATCC 38012. 33. Conidiophore. Bar = 7.5 µm. 34. Conidia. Bar = 5 µm.

μm x (2.9-)3.1-3.4(-3.5) μm. Ramoconidia (6.3-)8.8-11.4(-16.9) μm x (2.5-)3.2-3.5(-3.8) μm. Hyphae septate, light olivaceous, smooth, 2.7-3.0 μm wide.

Strains examined: ATCC 52853 ex-type, from rotting wood, Japan; ATCC 56961, from rotting wood, Japan, T. Iwatsu.

Remarks: ATCC 52853 is a subculture from holotype IFM 4700. The mean value of conidial size of ATCC 52853 is 8.0 x 3.3 μm, which is slightly longer than Iwatsu's description (mean = 7.1 x 3.3 μm). This species is morphologically similar to *Cladophialophora carrionii*. However, it can be distinguished from *C. carrionii* because *C. minourae* has wider conidia and a slightly higher maximum growth temperature (39C).

Cladosporium multigeniculatum W. Yamamoto, Sci. Rep.Hyogo Univ. Agric., Ser. Agric. Biol. 4(1):3, 1959. (Nom inval., Art. 37.1)

Colonies attaining 65mm in diameter on malt extract agar at 25C in 2 weeks, effuse, grayish olivaceous, velvety; reverse grayish black. Conidiophores light olivaceous to olivaceous, macronematous, straight or flexuous, usually simple but sometimes branched, intercalary or terminal, smooth, septate, the upper portion tapered toward the apex, up to 620 μm high, (2.9-)3.3-3.7(-4.0) μm wide, apically truncate with several denticulate hila, or if proliferated, multi-geniculate at apical fertile portion extending for up to 100 μm (Fig. 33). Conidia in simple or branched chains, oval, limoniform, fusiform, light olive, 0-septate, smooth, with a prominent, protuberant, dark scar at each end (Fig. 34). Conidia with 1-2 scars measured (5.4-)6.2-7.0(-9.4) μm x (2.5-)3.2-3.8(-4.3) μm. Conidia with more than two scars cylindrical, pale olive, 0-1-septate, (8.8-)9.7-11.8(-15.6) μm x (3.0-)3.5-3.9(-4.8) μm wide. Hyphae septate, light olivaceous buff, smooth, 2.6-3.0 μm wide.

Strain examined: ATCC 38012, from bamboo slats, Japan, W. Yamamoto.

Remarks: The diagnostic character of this fungus is the multigeniculate, apical fertile portion of conidiophores that extends for up to 100 μm. Yamamoto apparently did not designate a type. ATCC 38012 originated as IFO 6539 from Yamamoto. Figure 33/34 is here designated lectotype, with lyophilized culture of ATCC 38012, batch 12-13-78 as epitype.

Cladosporium musae Mason in Martyn, Mycol. Pap. 13:2-3. 1945.

Colonies attaining 36 mm in diameter on malt extract agar at 25C in 2 weeks, effuse, pale olivaceous to olivaceous gray, velvety; reverse greenish black. Conidiophores micronematous and macronematous. Micronematous conidiophores hyaline, straight or flexuous, simple, intercalary, erect from vegetative hyphae, with usually simple conidial chains formed at the apex. Macronematous conidiophores olivaceous to dark brown, usually paler at the upper portion, thick walled, stout, smooth, septate, slightly tapered toward the apex, arising from a single, inflated, dark brown globose cell, or from a more or less globose group of dark brown cells (Fig. 35). Macronematous conidiophores arise singly or in tufts of 2-7, with short, rhizoid-like hyphae growing from the base, and grow up to 600 µm long, usually between 420-520 µm, 6.5-7.5 mm wide, not geniculate nor nodose, and form appressed, ramuli- or metulae-like branches, which usually subtend a septum, and reach almost the same level at their apices (Fig. 36). Conidia in simple or branched chains, fusiform, ellipsoid, sub-hyaline, 0-(1)-septate, smooth, with a prominent, protuberant, dark scar at each end (Fig. 37). Conidia with 1-2 scars measured (6.3-)9.1-12.0(-14.4) µm x (3.3-)3.8-4.2(-4.4) µm. Ramoconidia fusiform, 0-(1) septate, (12.5-)15.3-17.2(-18.8) µm x (2.8-)3.9-4.3(-3.1) µm. Hyphae septate, subhyaline, smooth, 1.5-3.1 µm wide.

Strains examined: ATCC 36952, *Musa* sp., France, L. Bur; ATCC 36973, *Musa* sp., Honduras, R.H. Stover.

Remarks: Ellis (1971) described conidiophores with swollen bases, which were conspicuous in ATCC 36952 but not in ATCC 36973.

Cladosporium nigrellum Ellis & Everh., Proc. Acad. Nat. Sci. Philadelphia. 1893: 463, 1894.

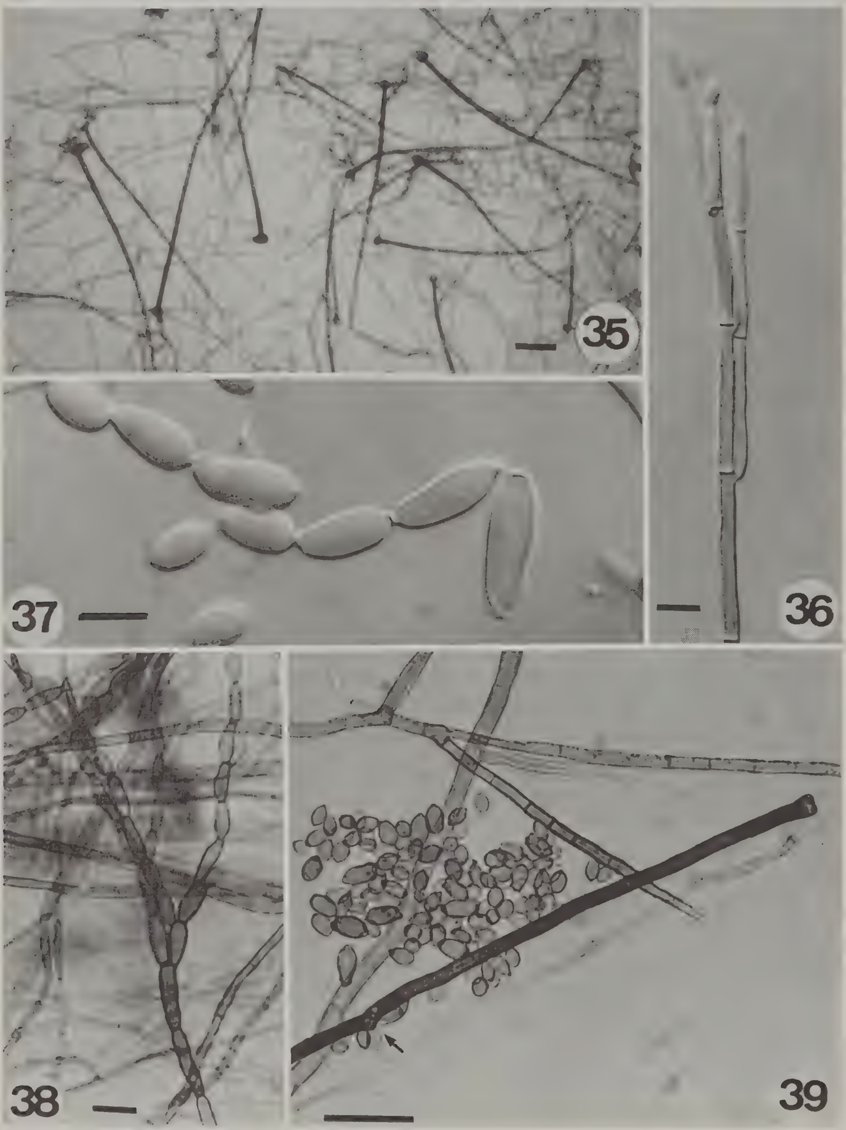
Colonies attaining 15 mm in diameter on malt extract agar at 25C in 2 weeks, velutinous to lightly floccose, deep blackish olive with similarly colored reverse. Conidiophores macronematous, olive brown, smooth, usually 20-30 µm long (but up to 50-60 µm is not uncommon) by (2.5-)3-4 µm. Conidia in branched chains, smooth, olive brown, 0(-1)septate, (8-)9-16(-22) x (2.5-)3-4.5(-5) µm, with typical dark scars (Fig. 38). Ramoconidia usually 0-1 sepate,10-25 µm x 4-6 mm, colored as the conidia. Hyphae subhyaline to olive brown, septate, 2-4 µm diameter.

Strain examined: ATCC 200937 (CBS 621.84, det. G.S. de Hoog), from leaf of decaying *Fagus sylvatica*, Netherlands.

Remarks: ATCC 200937 does not completely conform to the descriptions in Ellis (1976) or Morgan-Jones (1977). The conidia of ATCC 200937are slightly more narrow, never verruculose, and have fewer septa than described. Conidiophores are also more reduced. This may be an instance of progressive loss of characters as the strain spends more time in culture.

Cladosporium oxysporum Berk. & Curt., J. Linn. Soc., 10:362, 1868.

Colonies attaining 53 mm in diameter on malt extract agar at 25C in 2 weeks, olivaceous, velutinous, reverse greenish black. Conidiophores light olivaceous to dark brown, semimacronematous, macronematous, straight or flexuous, usually simple or sometimes branched, intercalary or terminal, smooth, septate, thick walled,



Figs. 35-39. 35-37. *Cladosporium musae*. 35. ATCC 36952. Bases of conidiophores. Bar = 25 μm. 36. ATCC 36973. Conidiophore with metula-like branches. Bar = 10 μm. 37. ATCC 36973. Conidia. Bar = 7.5 μm. 38. *Cladosporium nigrellum* ATCC 200937. Chains of conidia. Bar = 10 μm. 39. *Cladosporium oxysporum* ATCC 76499. Conidiophore with intercalary node (arrow) and conidia. Bar = 25 μm.

up to 800-1000 µm long, usually between 170-500 µm, (2.9-)3.2-3.5(-4.0) µm wide, distinctly nodose, terminal and intercalary nodes 4.9-5.6 µm in diameter, with dark, slightly protruding scars at conidiogenous loci (Fig. 39). Conidia in simple or branched chains, arising from terminal nodes which later become intercalary, subglobose, limoniform, ellipsoid, cylindrical with rounded ends, light olive, 0-1-septate, smooth, with a prominent, protuberant, dark scar at each end. Conidia with 1-2 scars measured (5.0-)5.6-7.1(-9.4) µm x (3.1-)3.4-4.1(-5.9) µm. Ramoconidia clavate, pale olive, 0-(1)-septate, (8.8-)11.2-13.7(-16.9) µm x (3.8-)4.3-4.9(-6.3) µm. Hyphae septate, light olivaceous, smooth, verruculose, 2.9-5.0 µm wide.

Strains examined: ATCC 76499, from decayed leaf of *Lespedeza bicolor*, Alabama, J.M. McKemy; ATCC 62734, from sunflower seed, North Dakota, R.G. Roberts.

Remarks: The slightly long, geniculate and nodose conidiophores, readily observed in culture, are the most readily diagnostic character for the species. Maximum *in vitro* lengths of conidiophores recorded in this study exceeded the corresponding lengths reported by McKemy and Morgan-Jones (1991b), maximum lengths for ramoconidia reported here are less than those reported by McKemy and Morgan-Jones, but growth rates are very similar in the two studies.

Cladosporium phlei (C. T. Gregory) de Vries, Contribution to the knowledge of the genus *Cladosporium* Link ex Fr., Baarn, p. 49, 1952.

Colonies attaining 27 mm in diameter on malt extract agar at 25C in 2 weeks, velutinous, pale vinaceous in center and gray olivaceous on margin; reverse black with vinaceous tint. Conidiophores brown, distinct, stout, smooth, septate, usually branched, geniculate and nodose on the upper portion, slightly swollen at tip, up to 445 µm long, usually 200-330 µm long, (3.8-)4.9-5.5(-6.3) µm wide (Fig. 40). Conidiogenous cells integrated, terminal, flexuous to sympodial, with protuberant dark cicatrized scars. Conidia solitary or in short unbranched chains, elliptical, oval, or oblong with rounded ends, 0-1-((2)-3)-septate, often slightly constricted at septa, verruculose, brown to golden brown, (10.8-)15.2-18.6(-21.9) µm x (6.3)7.5-8.4(-10.0) µm, with 1-2 prominent, protuberant, dark scars (Fig. 41). Hyphae septate, hyaline, thin, smooth, 4.9-5.5 µm wide.

Strain examined: ATCC 36193, from timothy grass, Japan, T. Narita.

Remarks: Conidia were mostly 0-1 septate, but in Matsushima (1975), conidia are mostly 1-3 septate.

Cladosporium sphaerospermum Penz., Michelia, 2:473, 1882.

Colonies attaining 33 mm in diameter on malt extract agar at 25C in 2 weeks, pale gray olivaceous to dark gray olivaceous, velvety, powdery; reverse olivaceous black. Conidiophores light olivaceous to olivaceous, semimacronematous, distinct, straight or flexuous, usually unbranched, sometimes branched, intercalary or terminal, stout, smooth, septate, up to 155 µm long, usually a much shorter 30-65 µm, 3.0-3.7 µm wide, not geniculate (Fig. 42). Conidia in simple or branched chains, globose, subglobose, limoniform, 0-(1)-septate, minutely verruculose, light olive, (5.6-)6.7-7.6(-9.4) µm x (3.8)5.5-6.2(-6.9) µm, with a prominent, protuberant, dark scar at each end (Fig. 43). Ramocondia subglobose to cylindrical, pale olive, 1-2-(4) septate, (10.0-)13.2-17.4(-20.4) µm x (5.0-)5.7-6.5(-7.5) µm wide. Hyphae densely septate, olivaceous brown, smooth, 4.8-5.1 µm thick.

Strains examined: ATCC 11290 (CBS 188.54, det. G.A. de Vries); ATCC12092, Begonia stem rot, Netherlands; ATCC 11292, soil, Canada; ATCC 62723, from sunflower seed, North Dakota, R.G. Roberts.

Cladosporium staurophorum (Kendrick) M. B. Ellis, More Dematiaceous Hyphomycetes, p. 333, 1976.
Hormodendrum staurophorum Kendrick, Can. J. Bot. 39:835, 1961.

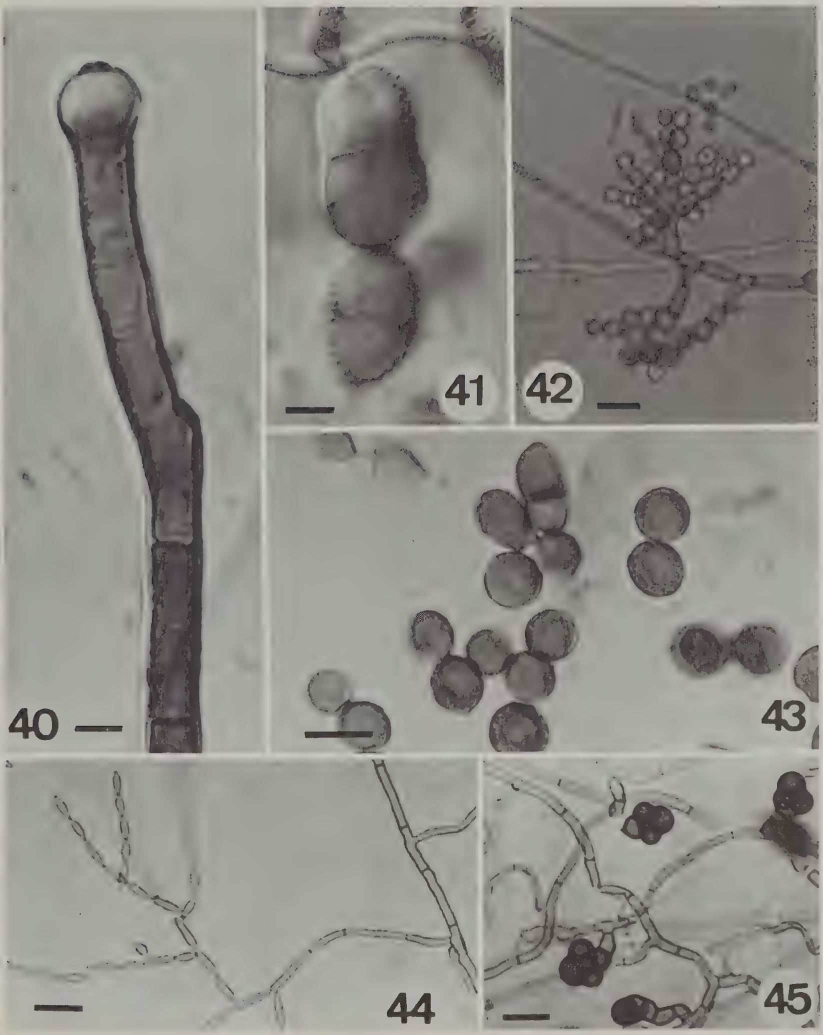
Colonies growing slowly attaining 15 mm in diameter on malt extract agar at 25C in 2 weeks, olivaceous, thin; reverse iron gray. Conidiophores pale olivaceous, micronematous, straight, simple or branched, intercalary or terminal, smooth, septate, up to 95 µm high, usually much shorter, 30-50 µm long, (1.9-)2.1-2.4(-2.8) µm wide, neither geniculate nor nodose, without extended apical proliferation, with denticulate scars at the truncated apex. Conidia in long, simple or branched chains, fusiform, ellipsoid, oblong, light olive, 0-1-septate, smooth, with a prominent, protuberant, dark scar at each end (Fig. 44). Conidia with 1-2 scars measured (5.1-)7.2-9.2(-11.8) µm x (1.8-)2.2-2.4(-2.9) µm in the broadest part. Ramoconidia fusiform or cylindrical, pale olive, 0-1-septate, (5.6-)8.2-10.6(-14.4) µm x (1.8-)2.2-2.4(-2.5) µm. Hyphae septate, pale to mid-olivaceous, smooth, (1.9-)2.1-2.3(-2.8) µm wide. Characteristic dark brown, usually cruciform, mostly 5-celled chlamydospores are formed abundantly on hyphae (Fig. 45).

Strains examined: ATCC 200934 (CBS 375.81, det. W. Gams), soil, Colombia.

Remarks: The dark brown chlamydospores are the most diagnostic character of this species. The gross morphology of this species is *Cladophialophora*-like, but conidial scars are prominent.

Cladosporium tenuissimum Cooke, Grevillea 6: 140, 1878.

Colony growth rate variable, approximately 30-75 mm in diameter on malt extract agar at 25C in 2 weeks, dark olive green, flocculose, occasionally farinaceous in areas of intense sporulation; reverse olivaceous black. Conidiophores olivaceous, macronematous, straight, unbranched, intercalary or terminal, smooth, septate, up to 850 µm high, usually 500-750 µm, approximately 4 µm wide, neither geniculate nor nodose, without extended apical proliferation, with truncate, apical conidiogenous apex (Fig. 46). Conidia forming at the apices of conidiophores in branched chains,



Figs. 40-45. 40-41. *Cladosporium phlei* ATCC 36193. 40. Conidiophore. Bar = 5 µm. 41. Conidia. Bar = 5 µm. 42-43. *Cladosporium sphaerospermum* ATCC 11290. 42. Conidiophores and conidia. Bar = 12.7 µm. 43. Conidia. Bar = 7.5 µm. 44-45. *Cladosporium staurophorum* ATCC 200934. 44. Conidiophore and conidia. Bar = 10 µm. 45. Chlamydospores. Bar = 10 µm.

limoniform, oval to ellipsoid, occasionally oblong, light olive, mostly 0-septate, smooth to minutely echinulate, with a prominent, protuberant, dark scar at each end (Fig. 47). Smaller conidia with 1-2 scars measured (4.5-)6.0-9.0(-12.0) µm x (2.5-)3.0-4.5 µm. Ramoconidia oblong to cylindrical, olive, 0(-1) septate, 14.5-27.0 µm x 4.0-5.0 µm.

Strains examined: ATCC 38027, from soil, New Caledonia, B. Huguenin; ATCC 62337, toad, Nigeria, H.C. Gugnani.

Remarks: This species differs from *C. oxysporum* by the absence of the nodose conidiophores of the latter. Although growth rates of the two strains varied, other characters were largely consistent.

Cladosporium uniseptosporum Matsushima, Icones Microfungorum a Matsushina Lectorum, Kobe, p. 36, 1975.

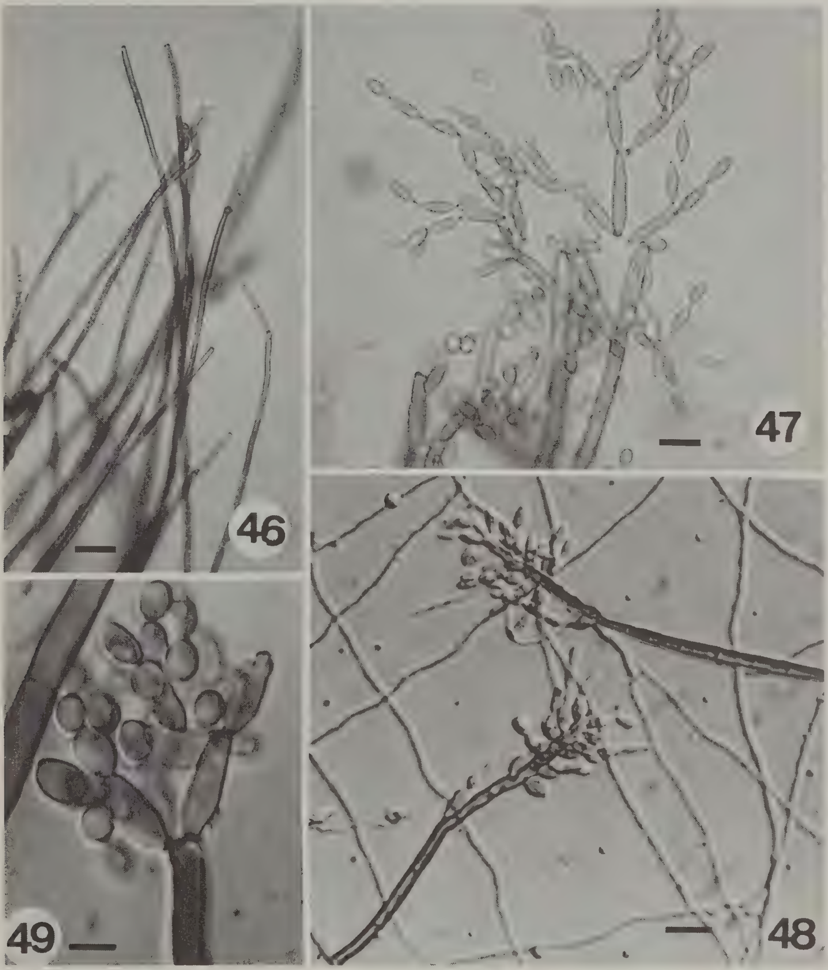
Colonies growing very slowly, attaining approximately 2 mm in diameter on malt extract agar at 25C in 2 weeks, olivaceous green to olivaceous brown, flocculose, velvety; reverse olivaceous black. Conidiophores pale olivaceous to olivaceous, macronematous, straight, simple, intercalary, erect from vegetative hyphae, smooth, septate, thick walled, up to 116 µm high, usually shorter, between 50-80 µm, (2.3-)2.5-2.8(-3.3) µm wide, apical fertile portion pale, frequently semi-sympodial, rachis-like, without nodes. Conidia forming in mostly unbranched, chains at or near apices of conidiophores, up to 5 conidia per chain, mostly ellipsoid, fusiform, sometimes oval, hyaline to light olive, 0-1-(2)-septate, smooth, (6.3-)7.1-8.4(-10.6) µm x (2.0-)2.6-3.0(-3.5) µm, with 1-2 prominent scars (Fig. 48). Hyphae septate, hyaline, smooth. From hyphae near the bases of conidiophores are usually 1-3 tapered, septate, short, simple, rhizoid-like hyphae.

Culture studied: ATCC 200935 (CBS 660.93, det. W. Gams), from old basidiome of *Trichaptum abietinum*, Belgium.

Remarks: Conidial chains are simple in these studies, differing from Matsushima (1975) where conidial chains were described and illustrated as simple or branched; rhizoid-like structures were not reported.

Cladosporium uredinicola Spegzzini, An. Mus. nac. Hist. nat. B. Aires 23: 122, 1912.

Colonies attaining 50 mm in diameter on malt extract agar at 25C in 2 weeks, grayish olivaceous to olivaceous, velvety; reverse greenish black. Conidiophores light olivaceous to dark olivaceous, semimacronematous, macronematous, straight or flexuous, simple or occasionally branched, intercalary or terminal, stout, thick walled, smooth to verruculose, septate, up to 290 µm high, usually 120-170 µm, (2.5-)3.3-3.7(-4.1) µm wide, neither geniculate nor nodose, usually with 2-3 protruding



Figs. 46-49. Figs. 46-47. *Cladosporium tenuissimum* ATCC 62337. 46: Conidiophores. Bar = 25 µm. 47. Conidiophore apex and conidia. Bar = 8 µm. 48. *Cladosporium uniseptosporum* ATCC 200935. Conidiophores and conidia. Bar = 10 µm. 49. *Cladosporium uredinicola* ATCC 46649. Conidiophore apex with conidia. Bar = 5 µm.

scars at the apex (Fig. 49). Conidiogenous cells integrated, terminal. Conidia in branched chains, ellipsoid or oblong, light olive, 0-(1)-septate, smooth, with a prominent, protuberant, dark scar at each end. Conidia with 1-2 scars measured (5.0-)5.9-8.2(-16.5) µm x (2.9-)3.3-3.6(-3.8) µm. Ramoconidia oblong, cylindrical, pale olive, 0-1-septate, (6.0-)9.9-12.2(-15.6) µm x (2.5-)3.3-3.6(-4.1) µm. Hyphae septate, olivaceous brown, smooth or verruculose, (2.5-)3.3-4.0(-5.6) µm thick.

Remarks: Geniculate conidiophores were not observed, but such were noted and illustrated by Morgan-Jones and McKemy (1990), who remarked that morphology in this species varies considerably between *in planta* and *in vitro* material. The lengths of conidia and conidiophores reported by Morgan-Jones and McKemy (1990) exceed those reported here.

Culture studied: ATCC 46649, hyperparasite on *Cronartium fusiforme* f. sp. *quercum*, Alabama, G. Morgan-Jones.

Cladosporium variabile (Cooke) de Vries, Contribution to the knowledge of the genus *Cladosporium* Link ex Fr., p. 85, 1952.
Heterosporium variabile Cooke, Grevillea 5:123, 1877
Helminthosporium variabile Cooke, Fungi Brit. 2, no. 360, 1870.

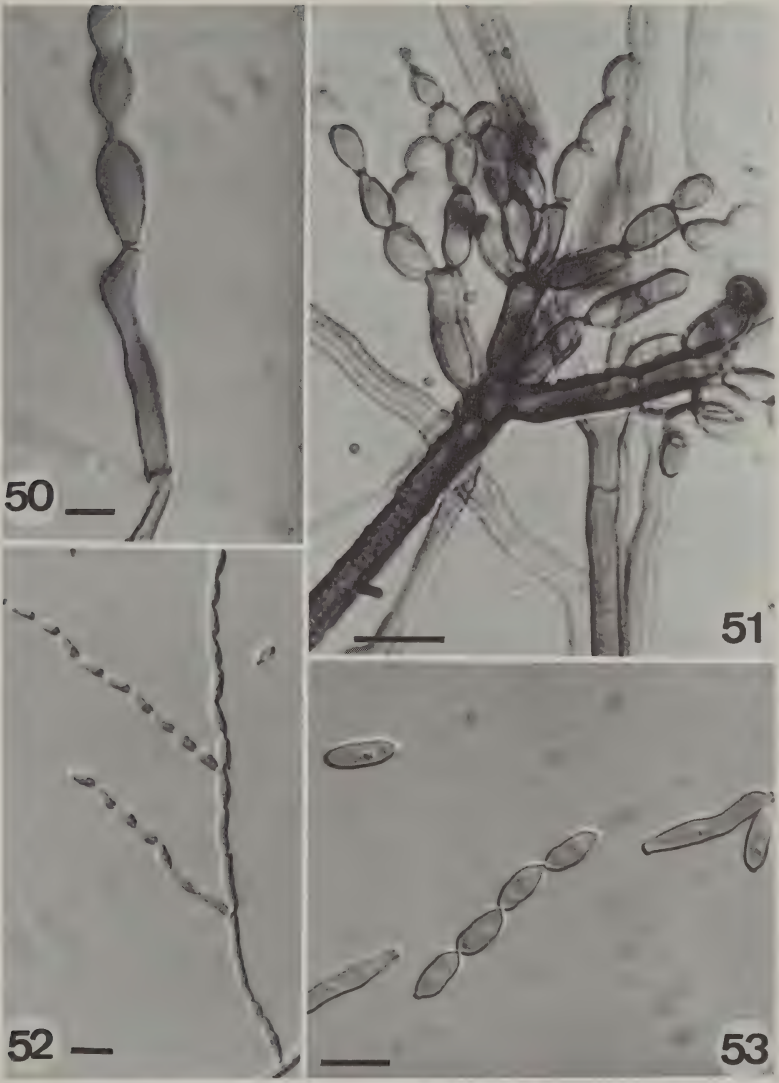
Colonies attaining 20 mm in diameter on malt extract agar at 25C in 2 weeks, off-white (diminished sporulation), flocculose; reverse light brick. Conidiophores light olivaceous, semimacronematous, distinct, straight or flexuous, usually unbranched, intercalary or terminal, brown, stout, smooth, septate, geniculate and nodose on the upper portion, up to 150 µm high, usually shorter about 50-75 µm long, (2.9-)3.5-3.9(-5.0) µm wide. Conidiogenous cells integrated, terminal, proliferating sympodially, with protuberant cicatrized scars. Conidia solitary or in short branched chains, ovoid, ellipsoid, or fusiform with truncated ends, 0-(1-(2))-septate, verruculose, hyaline to greenish olive, (6.3-)14.4-16.1(-27.5) µm x (3.3-)4.2-4.9(-6.3) µm, with 1-2 prominent, protuberant, dark scars (Fig. 50). Hyphae septate, hyaline to olivaceous, smooth, with occasional hyphal swellings.

Strain examined: ATCC 11295, from spinach, J. Labrousse.

Remarks: Conidia were a little smaller than described in Ellis (1971). Most conidia were 1-celled as opposed to Ellis' observation of 0-3 septa.

Cladosporium vignae Gardner, Phytopathology 15: 457, 1925.

Colonies attaining 65 mm in diameter on malt extract agar at 25C in 2 weeks, pale olivaceous gray, flocculose, velvety; reverse dark brick. Conidiophores pale to mid-olivaceous to olivaceous, semimacronematous or macronematous, straight or slightly flexuous, usually simple, intercalary or terminal, stout, smooth or sometimes verruculose toward the base, septate, up to 250 µm high, usually 75-135 µm, (3.3-)



Figs. 50-53. 50. *Cladosporium variabile* ATCC 11295. Conidiophore and conidia. Bar = 5 µm. 51. *Cladosporium vignae* ATCC 90242. Conidiophore and conidia. Bar = 10 µm. 52-53. *Cladophialophora bantiana* ATCC 10958. 52. Conidiophores and conidia. Bar = 10 µm. 53. Conidia. Bar = 7.5 µm.

3.6-4.1(-5.0) µm wide, bearing a number of ramoconidia apically or subapically, fertile conidiogenous area restricted, usually with groups of 2-3 scars at the apex and sometimes subapically (Fig. 51). Conidiogenous cells integrated, usually terminal, with limited sympodial growth, bearing several conidial scars. Conidia in branched chains, subglobose, limoniform, fusiform, ellipsoid, oblong, light olive to olive, 0-1-(2)-septate, smooth, with a prominent, protuberant, dark scar at each end. Conidia with 1-2 scars measured (6.0-)7.4-11.1(-20.6) µm x (2.5-)3.3-3.9(-4.6) µm. Conidia with more than two scars pale olive, 1-2-(3) septate, (6.3-)10.6-18.8(-23.8) µm x (3.1-)3.7-4.2(-4.8) µm. Hyphae septate, pale olive, smooth or verruculose, (2.5-)2.9-3.7(-4.3) µm wide.

Strain examined: ATCC 90242, from *Lespedeza bicolor*, Alabama, G. Morgan-Jones.

Remarks: This species, close to *Cladosporium cladosporioides* in morphology, is separated from that species in our key solely on the basis of average length of ramoconidia. The description from Morgan-Jones and McKemy (1992) suggests this separation may be tenable.

Descriptions of *Cladophialophora*:

Cladophialophora bantiana (Sacc.) de Hoog, Kwon-Chung & McGinnis, J. Med. Vet. Mycol. 33:343, 1995.
Torula bantiana Sacc. Ann Mycol 10:320, 1912.
Cladosporium bantianum (Sacc.) Borelli, Riv. Anat. Patol. Oncol. 17:620, 1960.
Xylohypha bantiana (Sacc.) McGinnis, Padhye, Borelli & Ajello, J. Clin. Microbiol.23:1150, 1986.
Xylohypha emmonsii Padhye, McGinnis & Ajello, J. Clin. Microbiol. 26:704, 1988.
Cladosporium trichoides Emmons in Binford et al., Am. J. Clin. Pathol. 22:535, 1952.
Cladosporium trichoides var. *chlamydosporum* Kwon-Chung, Mycologia 75: 320, 1983.

Colonies attaining 27 mm in diameter on malt extract agar at 25C in 2 weeks, pale olive green to grayish olive, velvety to powdery; reverse greenish black. Conidiophores absent or not well differentiated, olive buff, simple or branched, intercalary or terminal, smooth, septate, usually 50-75(100) µm long, 1.8-2.0 µm wide. Conidia forming long branching chains (up to 25 conidia per chain), branching two to three times per coniodiphore head, oblong, fusiform, 0-septate, smooth, olivaceous buff to olive, (6.3-)7.5-8.1(-11.5) µm x (2.50-)2.6-3.6(-5.3) µm, with two truncated ends (Figs. 52, 53). Ramoconidia oblong, fusiform, 10.4-13.4 µm x 2.5-2.8 µm. Chlamydospores sometimes present, globose, olive, intercalary in hyphae or conidial chains or terminal. Hyphae septate, olivaceous buff to olive, smooth.

Cultures studied: ATCC 10958, ex-type of *C. trichoides*, from human brain abscess, USA, C.W. Emmons; ATCC 46715, ex-type of *C. tichoides* var. *chlamydosporum*, from human brain abscess, Maryland, J.K. Kwon-Chung; ATCC 62584, A.A.

Pahdye.

Remarks: Conidiophores branch more profusely in ATCC 46715 than in 10958. Chlamydospores were present only in ATCC 46715.

Cladophialophora carrionii (Trejos) de Hoog, Kwon-Chung & McGinnis, J. Med. Vet. Mycol. 33:345, 1995.
Cladosporium carrionii Trejos, Revta. Biol. Trop. 2:106, 1954.
Cladophialophora ajelloi Borelli, Pan. Am. Health Organ. Sci. Publ. 396:335, 1980.

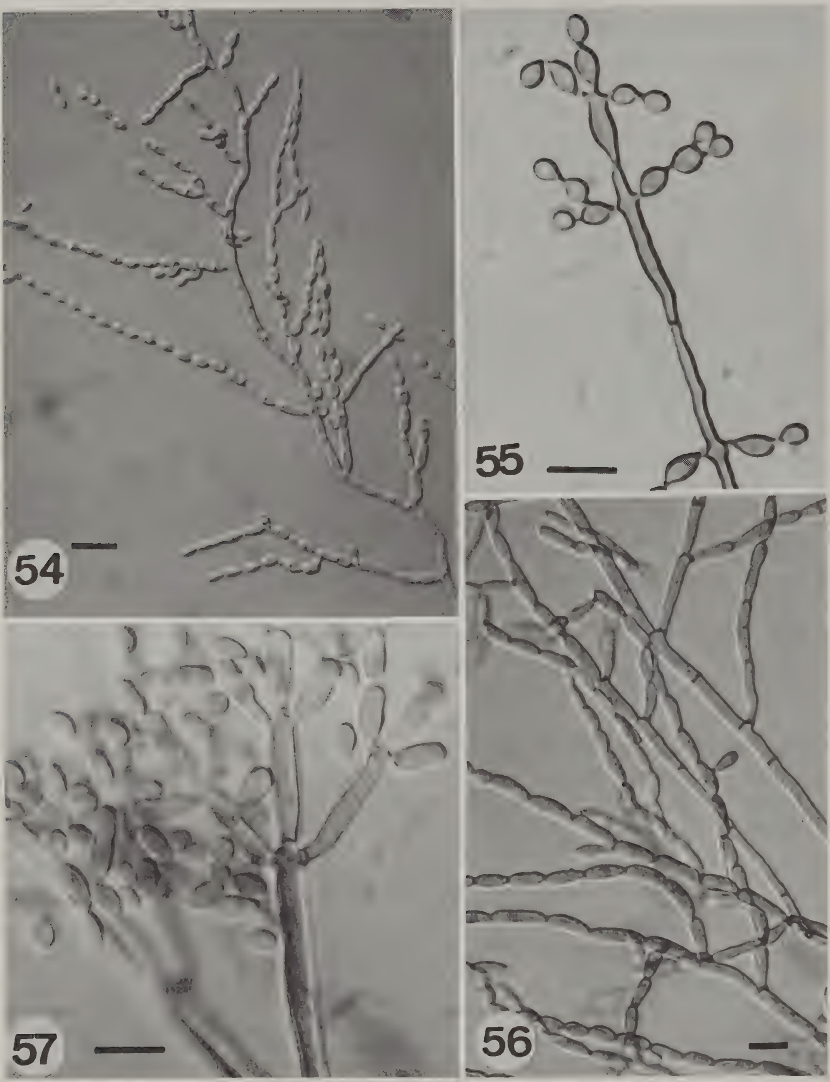
Colonies on malt extract agar at 25C measured 25 mm diameter in 2 weeks, pale olivaceous gray, pale olivaceous, velvety to powdery; reverse greenish black. Conidiophores lacking to micronematous, sometimes up to 100 µm but usually shorter, olive buff, simple or branched, intercalary or terminal, smooth, septate, (1.6-)2.0-2.3(-2.5) µm wide, slightly constricted at the base (Fig. 54). Conidia forming long profusely branching chains (up to 40 conidia per chain), branching several times per conidiophore head, oblong, fusiform, ellipsoid or limoniform, 0-septate, smooth, olivaceous buff, (5.0-)5.6-6.9(-9.8) µm x (2.0-)2.4-2.5(-2.6) µm. Ramoconidia (5.0-)6.3-8.3(12.5) µm x (2.0-)2.3-2.5 µm. Hyphae septate, olivaceous buff, smooth, 1.7-2.1 µm thick.

Strains examined: ATCC 16264, human chromoblastomycosis, Australia, C.W. Emmons; ATCC 44535, ex-type of *C. ajelloi*, human skin, Uganda.

Cladophialophora devrisii (Padhye & Ajello) de Hoog, Kwon-chung & McGinnis, J. Med. Vet. Mycol. 33:344, 1995.
Cladosporium devriesii Padhye & Ajello, in Gonzalez et al., Sabouraudia 22:430, 1984.

Colonies on malt extract agar at 25C measured 12 mm diameter in 2 weeks, pale olive green, flocculose; reverse olivaceous black. Conidial chains sessile or on undifferentiated conidiophores. Conidiophores pale olive buff, simple, intercalary or terminal, smooth, septate, up to 100 µm long but usually shorter, (1.3-)1.8-2.3(-2.5) µm wide, often with denticulate conidiogenous loci (Fig. 55). Conidia forming short branching chains (up to 4 conidia per chain), oval, oblong, or limoniform, pale olivaceous buff, 0-septate, smooth, with a prominent, protuberant, scar at each end, sometimes denticulate at branch points, (3.5-)5.0-6.4(-9.1) µm x (2.5-)2.6-2.8(-3.1) µm. Ramocondia fusiform, oval, pale olive buff, 0-septate, smooth, (5.3-)8.2-11.3(-15.0) µm x (2.5-)2.6-3.0(-3.8) µm. Hyphae septate, pale olive buff, smooth, 1.5-1.9 µm wide.

Strain examined: ATCC 56280, ex-type, breast mycetoma of human female, Grand Cayman Island.



Figs. 54-57. 54. *Cladophialophora carrionii* ATCC 44535. Conidiophores and conidia. Bar = 10 µm. 55. *Cladophialophora devriesii* ATCC 56280. Conidiophore and conidia. Bar = 7.5 µm. 56. *Cladophialophora hachijoensis* ATCC 96019. Bar = 10 µm. 57. *Hormoconis resinae* ATCC 11841. Conidiophore apices and conidia. Bar = 7.5 µm.

Cladophialophora hachijoensis Braun & Feiler, Microbiol. Res. 150:83, 1995.
Phaeoramularia hachijoensis Matsushima, Icones Microfungorum a Matsushima Lectorum, p.111, 1975.
?*Cladophialophora brevicatenata* Braun & Feiler, Microbiol. Res. 150:84, 1995.
Teleomorph:
Capronia hystrioides F.M. Dugan, R.G. Roberts & R.T. Hanlin, Mycologia 87:713, 1995
?*Venturia hanliniana* (Braun & Feiler) Untereiner, Mycologia 89:129, 1997.
?*Capronia hanliniana* Braun & Feiler, Microbiol. Res. 150:90, 1995.

Colonies on malt extract agar at 25C measured 38 mm diameter in 2 weeks, deep olive green, velutinous; reverse blackish olive. Conidiophores absent or reduced to long (3 µm) denticles, smooth, light olive, intercalary or rarely terminal. Conidia forming long, simple or branching chains along or on the apical portion of conidiophore (up to 25 per chain), fusiform, with two truncate ends, light olive, 0-(1) septate, smooth, (5.0-)7.0-12.0(-16.0) µm x (2.5-)3.0-3.5(-4.0) µm (Fig. 56). Ramoconidia fusiform, light olive, 0-(2) septate, smooth-walled, (10.0-)13.0-15.0(-30.0) µm x 3.0-4.0(-4.5) µm. Hyphae septate, subhyaline olivaceous buff, smooth, 2.4-3.0 µm thick. Blackish, yeast-like state sometimes present.

Strains examined: ATCC 96019, ex-type of *C. hysterioides*, from Bing cherry fruit, Washington state.

Remarks: Most conidia of this strain were aseptate; a few were 1-septate. In Matsushima (1975), conidia have 0-3 septa. Untereiner (1997) considered *Capronia hystrioides* conspecific with *Capronia hanliniana* Braun & Feiler and united them under the name *Venturia hanliniana* (Braun & Feiler) Untereiner. However, Braun and Feiler (1995) considered the two teleomorphs distinct, and the respective anamorphs (*Cladophialophora hachijoensis* and *Cladophialophora brevicatenata* Braun & Feiler) also distinct. Untereiner (1997) removed *Capronia hanliniana* to *Venturia* largely on the basis of ascospore color and the presence of pseudoparaphyses, and in spite of the *Cladophialophora* anamorph; she regarded the presence of a *Cladophialophora* anamorph as a possibly inconsistent indicator of phylogenetic affiliation. Dugan et al. (1995) discussed the relative merits of assignment to *Venturia* versus *Capronia* in terms of centrum morphology and other characters. See Untereiner and Naveau (1999) for a more extended discussion of the taxonomic placement of ATCC 96019, including its separation from BBA 65570 *C. hachijoensis* on the basis of 28S rDNA sequence data. None of these studies has had access to Matsushima's type material.

Hormoconis resinae (Lindau) Arx & de Vries, apud von Arx, Verh. K. Ned. Akad. Wet., Ser. 2 61(2):62, 1973.
Hormodendron resinae Lindau, Die Pilze Deutschlmands, Oesterreichs, und der Schweitz, Fungi Imperfecti in Rabenhorst's Krypogemen Flora 8:699, 1907.
Cladosporium resinae (Lindau) de Vries, Antonie van Leeuwenhoek 21:167, 1955.
?*Cladosporium avellaneum* de Vries, Contribution to the Knowledge of the Genus

Cladosporium p. 56, 1952

Teleomorph:
Amorphotheca resinae Parberry, Aust. J. Botany 17:340, 1969.

Colonies on malt extract agar at 25C 79 mm diameter in 2 weeks, olive gray-green, velutinous to finely farinaceous, reverse deep blackish olive. Conidiophores micronematous or more commonly macronematous, up to 900 µm long by 3-4 µm wide, olive, verrucose or occasionally smooth, straight to slightly flexuous (Fig. 57). Conidia aseptate, smooth, olive, 3-5(-6) x 2-3 µm, without conspicous scars. Ramoconidia aseptate, smooth, olive, up to 15 x 3.5 µm, but commonly shorter. Hyphae septate, smooth, light olive.

Strains examined: ATCC 11841, from creosote-treated wood, Missouri, C.M. Christensen; ATCC 200942 ex-type of *Amorphotheca resinae*, soil, U.K.

Remarks: The synonymy of *Cladosporium avellaneum* de Vries with *Hormodendron resinae* Lindau (≡ *Cladosporium resinae* (Lindau) de Vries ≡ *Hormoconis resinae* (Lindau) Arx & de Vries) as established by de Vries (1955) is accepted by Domsch et al. 1980, but the two are not listed as synonyms by Farr et al., 1989. Although all three sporulating forms of *C. avellaneum* (forma *viride*, forma *albidum* and forma *avellaneum*) arose as monosporous saltants from the parent culture, not all conformed to the *Hormoconis* concept. *Hormoconis* is differentiated from *Cladosporium* by the lack of conspicuous scars on conidia (Domsch et al. 1980, Ellis 1971). Although ATCC 11274 *C. avellaneum* f. *viride* produced conidia lacking conspicuous scars, ATCC 11723 *C. avellaneum* f. *avellaneum* displayed conspicuous scars. *C. avellaneum* f. *albidum* was not examined.

Provisional Key to *Cladosporium* and *Cladosporium*-like Species

1. Conidia with conspicuous scars 5
(*Cladosporium*)
1'. Conidia lacking conspicuous scars 2

2. Conidiophores lacking, or lacking to occasionally micronematous .....
.... *Cladophialophora* key
2'. Conidiophores consistently present and micronematous, or present and at least sometimes macronematous 3

3. Yeast-like cells and/or phialides present .... *Cladophialophora* key
3'. Yeast-like cells and/or phialides *not* present 4

4. Macronematous conidiophores up to 600 µm long, rigid and verrucose; conidial heads with metula-like branches .... *Cladosporium breviramosum*
4'. Conidiophores variable, in some isolates up to 2 mm, semi-macronematous, flexous, often irregularly verrucose; conidial heads without metula-like branches ....

.... *Hormoconis* (*Cladosporium*) state of *Amorphotheca resinae*
4" Not as above .... *Cladophialophora* key

5.(1) Largest conidiophores with conspicuously inflated bases or arising from dense clusters of melanized cells, apices with appressed, ramuli- and metulae-like branches .... *Cladosporium musae*
5'. Conidiophores otherwise 6

6. Abundant, dark brown, multicelled chlamydospores present ..... *Cladosporium staurophorum*
6'. Abundant multicelled chlamydospores not present 7

7. Ramoconidia alternarioid in outline, often with protuberant to denticulate conidiogenous loci .... *Cladosporium lignicola*
7'. Ramoconidia otherwise 8

8. Conidia catenulate, branching, often individually sinuate, mostly 18-23 µm long; conidiophores occasionally with unilateral nodose swellings .... *Cladosporium* (*Fulvia*) *fulvum*
8'. Not with the above characters 9

9. Conidiophores straight, semimacronematous, simple; conidia catenulate, mostly fusiform, when branching proliferating from ramoconidia; appressoria and spiral or toruloid hyphae formed on slides and coverslips .... *Cladosporium caryigenum*
9'. Not with above characters 10

10. Conidia mostly verrucose 11
10'. Conidia smooth or minutely verruculose...................................... 17

11. Conidia mainly globose to subglobose .... *Cladosporium sphaerospermum*
11'. Conidia otherwise 12

12. Conidiophores flexuous, but not nodose .... *Cladosporium magnusianum*
12'. Conidiophores flexuous to geniculate, nodose 13

13. Conidia mostly ellipsoid, with length/width ratio ≥ 3 14
13'. Conidia with length/width ratio < 3 15

14. Conidia mostly over 20 µm long .... *Cladosporium echinulatum*
14'. Conidia mostly less than 20 µm long .... *Cladosporium variabile*

15. Conidial chains with little or no branching .... *Cladosporium phlei*
15'. Conidial chains commonly branched 16

16. Conidia mostly over 14 µm long, commonly 1-septate .... *Cladosporium*

herbarum var. *macrocarpum*
16'. Conidia mostly over 14 μm long, commonly 0-septate, rarely 1-septate .... *Cladosporium allii-porri*
16". Conidia mostly less than 14 μm long .... *Cladosporium herbarum*

17.(10') Conidia fusiform to subcylindrical 18
17'. Conidia (at least those near chain termini) shorter relative to width (ellipsoid to globose, or slightly constricted in the middle) 20

18. Conidia mostly 0-septate, subcylindrical, catenulate, occasionally branching, on short nodose conidiophores .... *Cladosporium malorum*
18'. Conidia and/or conidiophores otherwise 19

19. Conidia mostly 0-septate *in culture*, fusiform to sinuate, in long chains, occasionally branching, on short, non-nodose conidiophores .... *Cladosporium nigrellum*
19'. Conidia mostly 0-septate, fusiform, solitary to chains of 3-4, occasionally branching, on short, non-nodose conidiophores .... *Cladosporium carpophilum* (= *Fusicladium carpophilum*, not examined in culture).

20.(17') Conidiophores consistently micronematous; macronematous conidiophores absent to rare 21
20'. Conidiophores commonly macronematous 22

21. Conidiogenous sites on branching conidia often projecting to denticulate; conidia toward base of chain elongated with distal end wider than proximal end; macronematous conidiophores rare; micronematous conidiophores often intergrading into long chains of elongate, sinuate ramoconidia prior to apex bearing more ellipsoid conidia .... *Cladosporium elatum*
21' Conidiogenous sites on conidia not projecting, conidia more uniformly ellipsoid .... *Cladosporium minourae*

22. Conidial heads often more dense than typical of most *Cladosporium*; basal ramoconidia often produced in verticils............. *Cladosporium chlorocephalum*
22'. Conidial heads not more dense than typical of the genus; basal ramoconidia not frequently in verticils 23

23. Conidiophores commonly up to 500 μm or longer, or if shorter, rigid, and verrucose with metulae-like apical branches 24
23' Conidiophores less long 26

24. Many conidiophores with intercalary nodes; conidia mostly 5-7 μm long and 0-(1)-septate .... *Cladosporium oxysporum*
24'. Many conidiophores with intercalary nodes; conidia mostly 14-17 μm long and

0-(3)-septate .... *Cladosporium colocasiae*
24". Conidiophores without intercalary nodes 25

25. Conidiophores with obvious apical, sympodial geniculations; metula-like branches lacking .... *Cladosporium multigeniculatum*
25' Conidiophores lacking apical sympodial geniculations; metula-like branches lacking .... *Cladosporium tenuissimum*
25" Conidiophores verrucose, conidia with relatively inconspicuous scars; metula-like branches often present .... *Cladosporium breviramosum*

26.(23') Many conidiophore apices conspicuously rachis-like; conidial chains short and little-branched; conidial L/W often <3 and averaging <3 .... *Cladosporium uniseptospoum*
26' Many conidiophore apices rachis-like; conidial chains more branched; conidial L/W consistently >3 and averaging >4 .... *Cladosporium amoenum*
26". Conidiophores otherwise 27

27. Young hyphae with conspicuous spiral (corkscrew) termini .... *Cladosporium cucumerinum*
27' Young hyphae not so formed 28

28. Ramoconidia averaging approximately 18 µm long, L/W averaging approx. 6 .... *Cladosporium coralloides*
28'. Ramoconidia averaging approximately 14 µm long, L/W averaging approx. 3.5 .... *Cladosporium vignae*
28". Ramoconidia less long 29

29. Ramoconidia averaging approx. 12.5 µm long, L/W averaging approx. 3.5 .... *Cladosporium cladosporioides*
29'. Ramoconidia averaging approx. 10-11 µm, L/W averaging approx. 3-3.5 .... *Cladosporium laxicapitulatum*, *Cldsp. uredinicola*, *Cldsp. gossypiicola*

***Cladophialophora* and *Cladophialophora*-like species**

(1) (from 2,3,4" 1st key) Micronematous or macronematous conidiophores commonly present .... (2)
(1') Conidiophores not well-developed, conidia produced from denticles or produced sessile on hyphae .... (9)

(2) Most conidia ellipsoid, limoniform to fusiform .... (3)
(2') Most conidia longer: fusiform to subcylindrical .... (6)

(3) Phialides (annelides), yeast state, and torulose hyphae present .. *Exophiala dermatitidis* (*Cladophialophora* state rarely present; not described here)

(3') Phialides present or absent, no yeast state and torulose hyphae .... (4)

(4) Growth at 40C, phialides unknown .... *Cladophialophora arxii*
(No strains studied in culture at ATCC - known from a single case in Germany)
(4') No growth at 40C, phialides present or absent .... (5)

(5) Conidia 0-septate, mostly limoniform to short fusiform with many conidiogenous loci conspicuously protuberant; conidia averaging >3 µm wide, in long chains; phialides unknown .... *Cladosporium minourae*
(5') Conidia 0-septate, mostly limoniform to short fusiform, conidiogenous loci not protuberant, conidia averaging <2.5 µm wide, in long chains; phialides may be present .... *Cladophialophora carrionii*
(5'') Conidia 0-septate, mostly limoniform to ellipsoid, with occasional intercalary chains of fusiform conidia; most conidia >2.5 µm wide, with denticles at branch points, in short chains; no phialides known .... *Cladophialophora devriesii*

(6) (2') Growth at 40C, conidia 0-septate, with rounded ends, in long, seldom-branched chains .... *Cladophialophora bantiana*
(6') No growth at 40C or conidia in very short chains .... (7)

(7) Conidiogenous sites on branching conidia projecting to finely denticulate; conidia in long chains with proximal end of conidium more narrow than distal end .... *Cladosporium elatum*
(7') Conidiogenous sites on branching conidia not projecting or if so, more broadly truncate; conidia more symmetrical longitudinally .... (8)

(8) Conidia commonly 0(-1) septate, ends broadly truncate, in long chains ... *Cladosporium malorum*
(8') Conidia commonly (0-)1 septate, ends broadly truncate, in short chains ... *Cladophialophora brevicatenata* [Not examined in culture])

(9) (1') Conidia subglobose, in long chains, lacking ramoconidia .. *Cladophialophora boppii* (not examined in culture)
(9') Conidia commonly 0-1 septate, fusiform to subcylindrical, with ramoconidia, ends broadly truncate, in long chains; yeast-like state may be present .... *Cladophialophora hachijoensis*

Discussion

When grown in culture, strains of *Cladosporium* in the ATCC collection generally conformed to descriptions derived from material on plant hosts. However, reduction in sporulation capacity, conidial size and septation, and conidiophore development were manifest in some strains. The rapidity with which these characters are altered in culture is probably a function of the strain and the length of time in culture. Most noticeable was the reduction in conidial septation and size for strains assigned to *Cladosporium herbarum* var. *macrocarpum*; these strains increasingly resembled *C. herbarum* with successive transfer. *Cladosporium nigrellum* in culture displayed a conspicuous loss of septation compared to material described from plant hosts. Equally common was a tendency for production of a greater proportion of micronematous, or at least less robust, conidiophores; *Cladosporium breviramosum*, *C. oxysporum*, and *C. tenuissimum* furnished examples of this tendency. A strain of *Cladosporium musae* failed to exhibit the globose, dark conidiophore bases diagnostic for that species *in planta*, although bases of conidiophores remained conspicuously dark and rounded clusters of darkened cells were evident.

For *Cladosporium*, and for many other plant-associated hyphomycetes, the most useful cultural characters are not necessarily represented by means, but by extremes. Because of the reduction or sequential loss of well-developed characters in culture, the morphotaxonomist must be alert for the minority of instances which typify the terminus of a developmental range, and which much more nearly approximates the diagnostic *in planta* morphology than does the average for a given character. Unfortunately, these averages tend towards simplification and convergence. Therefore, although the recording of such averages is necessary, the means are by themselves are insufficient. Only the addition of data from the termini of quantitative characters enables a practical, culture-based morphotaxonomy.

Not unexpectedly, some *Cladosporium* strains, *Cladosporium minourae* and *Cladosporium elatum*, keyed better when grouped with *Cladophialophora*. From a morphological perspective, *Cladosporium malorum* also shares some *Cladophialophora*-like characters, although the conidiophores of most *C. malorum* strains are rather robust compared to those characteristic of *Cladophialophora*. The character of phialide production in *Cladophialophora* was not observed in any strain, nor was the character of less intense conidial scar color of consistent reliability. In the absence of production of phialides, no single morphological character enables consistent separation of *Cladosporium* from *Cladophialophora*. This would be true even if *Cladosporium minourae* and *Cladosporium elatum* were transferred to *Cladophialophora*.

Also expected was the failure to separate all strains on cultural criteria. Although *Cladosporium cladosporioides* could be separated from *Cladosporium laxicapitulatum*, *C. uredinicola* and *C. gossypiicola* for our strains, we anticipate that this separation would not persist if larger numbers of strains were examined. Moreover, the latter three species could not be separated from each other. However, it would be premature to declare them conspecific.

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MYCOTAXON

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TWO NEW SPECIES OF HYPOXYLON FROM MEXICO

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ABSTRACT

Two new species of **Hypoxylon**, **H. olliforme** and **H. texcalense** are described. Both were collected on dead wood in El Texcal, a median subdeciduous tropical forest in the state of Morelos, central México.

RESUMEN

Dos especies de **Hypoxylon, H. olliforme** y **H. texcalense** se describen como nuevas; ambas fueron recolectadas sobre madera muerta en El Texcal, un bosque tropical mediano subcaducifolio del estado de Morelos, en el centro de México.

INTRODUCTION

El Texcal is a median subdeciduous tropical forest in the Chichinautzin Biological Corridor. It is located in the northwest part of Morelos state in central México, its coordinates are: 18° 50' 30" Lat. N; 98° 51' 50" Long. W, with altitudes ranging from 1500 to 3450 m above the sea level. Geologically the area is shaped by extrusive igneus material from the Cenozoic with a pyroclastic surface (Contreras and Urbina, 1995). Common in the area are species of **Bursera**, **Cosmos**, **Echeveria**, **Fourcraea**, **Garrya**, **Mimosa**, **Oxalis**, **Pleurothallis**, **Quercus,** and **Tecoma** (López, 1990).

In this contribution two new species of **Hypoxylon**, **H. olliforme** and **H. texcalense** were identified following the taxonomic criteria of Ju and Rogers (1996). The modes of collecting and preservation of specimens follow San Martín and Rogers (1995). Determination of colors of the stromatal surfaces follow Kornerup and Wanscher (1967). Herbarium designations are largely based on Holmgren et al. (1990).

DESCRIPTIONS

Hypoxylon olliforme San Martín, Lavín et Portugal-Portugal. sp. nov. Figs. 1, 2, 3

Stromata effuso-pulvinata, inclinationis rosellinioidea, textura stromatica pertenuis connexa, pruinosa, tumulis peritheciorum ollae, valde conspicuis, 3-20 mm longa x 2-4 mm lata: externe porphyreus ad cinnabarinus, sub superficie et interperithecia granulis cinnabarinus conspersa, granulis cinnabarinus in KOH dissolutis. Perithecia spherica, 0.2-0.3 mm diametro. Ostiola umbilicata, pars substantia alba indutae et discus circumtextae circa 0.2 mm diametro. Asci 95-103 µm longitudine tota x 6.5-7 µm crassi, cum partibus sporiferis 65-71 µm longitudine, stipitibus 30-32 µm longitudine, annulo apicali in liquore iodato Melzeri cyanescente, discoideo, 1-1.5 µm alto x 2-2.5 µm lato. Ascosporae brunneae vel fuscae, unicellulares, ellipsoideo-inequilaterales vel lunatae apicibus perangustatis vel angustatis, 10.5-12 x 4.5-5 µm, rima germinativa recta vel parum sigmoidea dorsali longa praedita; perisporium in KOH dehiscens; episporium leve.

Status anamorphosis ignotus

Stromata effuse-pulvinate, with a tendency to be rosellinioid, but united by a very thin, pruinose, stromatal tissue, with very conspicuous, somewhat pot-like perithecial mounds, 3-20 mm long x 2-4 mm broad; surface brownish red (8C7) to reddish orange (7A8); red granules immediately beneath surface and between perithecia, with KOH extractable pigments reddish orange (7B8). Perithecia spherical, 0.2-0.3 mm diam. Ostioles lower than the stromatal surface, some covered by a white substance and circled by a disc ca 0.2 mm diam. Asci 95-103 µm total length x 6.5-7 µm broad, the spore-bearing part 65-71 µm long, the stipes 30-32 µm long, with apical ring bluing in Melzer´s iodine reagent, discoid, 1-1.5 µm high x 2-2.5 µm broad. Ascospores brown to dark brown, unicellular, ellipsoid-inequilateral to somewhat crescentic, with narrow to narrowly rounded ends, 10.5-12 x 4.5-5 µm with straight to slightly sigmoid germ slit spore-length on convex side; perispore dehiscing in 10% KOH; epispore smooth.

Anamorph unknown.

SPECIMEN EXAMINED: Morelos state, Tepoztlán municipality, Santa Catarina, El Texcal, alt. 1665 m, 18.IX.1998, San Martín 4156M, on decorticated wood in median semideciduous tropical forest (FSM, HOLOTYPE).

NOTES: The specific epithet alludes to the pot-like shape of the stroma. That peculiar perithecial shape set this fungus apart from any other **Hypoxylon** species known to us. In the nearly free, almost rosellinioid ascomata, **H. olliforme** approximates **H. lenormandii**, but the former has a different stromatal shape, different color of surface and pigments, and smaller ascospores i. e. 10.5-12 x 4.5-5 µm vs 9.5-15 (-16) x 4-6.5 (-7) µm.

Hypoxylon texcalense San Martín, Portugal-Portugal et Lavín. sp. nov. Figs. 4, 5, 6

Stromata glomerata vel pulvinata, tumulis peritheciorum conspicuis, 2-13 mm longa x 2-6 mm lata; externe roseus, subsuperficie et inter perithecia granulis nigellis conspersa, granulis violaceus in KOH dissolutis; textura sub peritheciis inconspicua vel conspicua. Perithecia globosa vel sub globosa, 0.4-0.6 mm diametro. Ostiola umbilicata. Asci 162.5-190.5 µm longitudine tota x 8-10 µm crassi, partibus sporiferis 98.5-106.5 µm longitudine, stipitibus 64-84 µm longitudine, annulo apicali absens vel reductus, inamyloideo. Ascosporae fuscae, unicellulares, ellipsoideo inequilaterales cum apicibus angustatis, (17-) 17.5-22 (-24) x (6.5-) 7- 9 (-9.5) µm, rima germinativa recta dorsali longa paredita; perisporium in KOH dissolutis dehiscens; episporium leve.

Status anamorphicus: nodulisporio simili.

Stromata glomerate to pulvinate, with conspicuous perithecial mounds, 2-13 mm long x 2-6 mm broad; surface pink (13A5); blackish granules dispersed immediately beneath surface and between perithecia, with KOH-extractable pigments violet (17E7); the tissue below the perithecial layer inconspicuous to conspicuous. Perithecia globose to subglobose,

0.4-0.6 mm diam. Ostioles umbilicate. Asci 162.5-190.5 µm total length x 8-10 µm broad, the spore-bearing parts 98.5-106.5 µm long, the stipes 64-84 µm long, apical ring absent or highly reduced, inamyloid. Ascospores dark-brown, unicellular, ellipsoid-inequilateral with narrowly rounded ends, (17-) 17.5-22 (-24) x (6.5-) 7- 9 (-9.5) µm, with straight germ slit spore-length on convex side; perispore dehiscent in 10% KOH; epispore smooth.

Anamorph in nature with conidiophores and conidiogenous cells **Nodulisporium**-like, the conidia hyaline, greenish in mass, ellipsoid with one end truncate, 5.5-8 x 3-4 µm.

SPECIMENS EXAMINED: Morelos state, Tepoztlán municipality, Santa Catarina, El Texcal, alt. 1695 m, 23.VIII.1998, San Martín 4024M, on corticated wood in median subdeciduous tropical forest (FSM, HOLOTYPE; ITCV, ISOPTYPE). Morelos state, Tepoztlán municipality, Santa Catarina, El Texcal alt. 1655 m, 18.IX.1998, San Martín 4178M, corticated wood in median subdeciduous tropical forest (FSM, TOPOTYPE).

NOTES: This taxon is easily recognized by its large spores, absence of ascal rings, black granules beneath the surface, pigments violet colored when extracted with 10% KOH, and the rosy stromatal surface. It belongs to section **Hypoxylon**, group D, subgroup II of Ju and Rogers (1996), but there is no taxon therein reminiscent of the Mexican material. The stromatal surface of **H. texcalense** is similar to that of **H. ravidoroseum** Ju and Rogers, but the latter has smaller ascospores i.e., 5-7 x 2.5-3.5 µm vs (17-) 17.5-22 (-24) x (6.5-) 7- 9 (-9.5) µm, and the ascal apical ring becomes blue in Melzer´s iodine reagent (Van der Gucht et al., 1995). Everything considered, **H. texcalense** is a highly distinctive fungus.

The specific name of this fungus refers the locality where it was collected.

AKNOWLEDGEMENTS

We are very grateful to the Sistema Nacional de Investigadores de México for providing grants for conducting field and taxonomic studies of Mexican Xylariaceae. We thank Dr. Rubén Durán, Hemet, California and Dr. Jack D. Rogers, Washington State University, for reading the manuscript, and the former also for criticizing the Latin descriptions.

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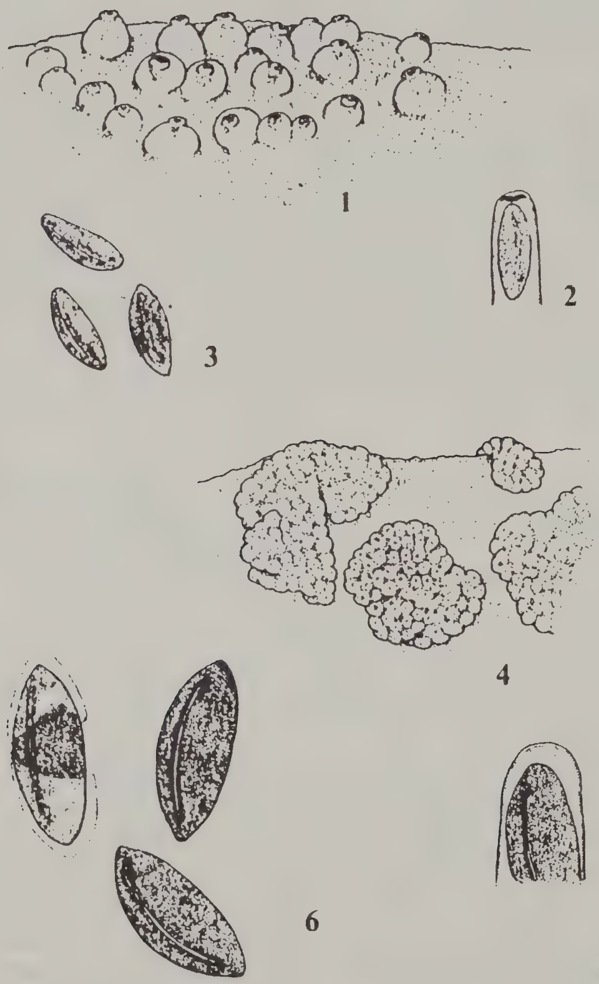

Figs. 1-6. 1-3: **Hypoxylon olliforme**: 1. Stromata 1 cm = 2.5 mm. 2. Discoid ascus apical ring 1 mm = 0.5 µm. 3. Ascospores with dehiscent perispore1 cm = 5 µm. 4-6: **Hypoxylon texcalense**: 4. Stromata 1 cm = 2.5 mm. 5. Ascus lacking an apical ring or highly reduced 1 mm = o.5 mm. 6. Ascospores with dehiscent perispore 1 cm = 5 µm.

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PSILACHNUM OPUNTIAE SP. NOV. (HYALOSCYPHACEAE) GROWING ON OPUNTIA CLADODES FROM MEXICO

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Abstract

A new species *Psilachnum opuntiae* R. Galán & Raitviir is described growing on skeletons of decayed cladodes of an *Opuntia* sp. from Baja California, Mexico

Key words : *Psilachnum*. Ascomycetes, new species,. Mexico.

Introduction

The present paper is a continuation of the studies by the first author started in 1990, in collaboration with several workers, with the aim to study the saprotrophic discomycetes growing in Baja California (Mexico) and to compare them with similar Spanish communities of fungi sharing the same Mediterranean distribution. The previous results have been published in several papers (Galán et al., 1993 ,1994). In the 1996 expedition to Baja California a hyaloscyphaceous discomycete was collected on a peculiar substrate, the woody skeletons of the old decomposed pads of fleshy cacti, which are called "nopal" in Mexico and are the cladodes of *Opuntia* subgenus *Platyopuntia* sp.

This substrate has been occasionally reported for some species of Myxomycetes, both in Spain (Lopez-Sanchez et al., 1986) as in Mexico (Lizárraga et al., 1997, 1998), but only one ascomycete species, plurivorous *Patellaria atrata* (Hedw.) Fr., has been found growing on such decomposed pads in Spain by the first author. Also *Coccomyces wagnerianus* (Rehm) Rehm, a rhytismataceous species of uncertain generic position, has been reported growing on *Opuntia. rafinesquii* from Germany (Sherwood, 1980).

The present discomycete, found abundantly growing on skeletons of decayed cladodes of an *Opuntia* sp., is described as a new species of the genus *Psilachnum* Höhn.

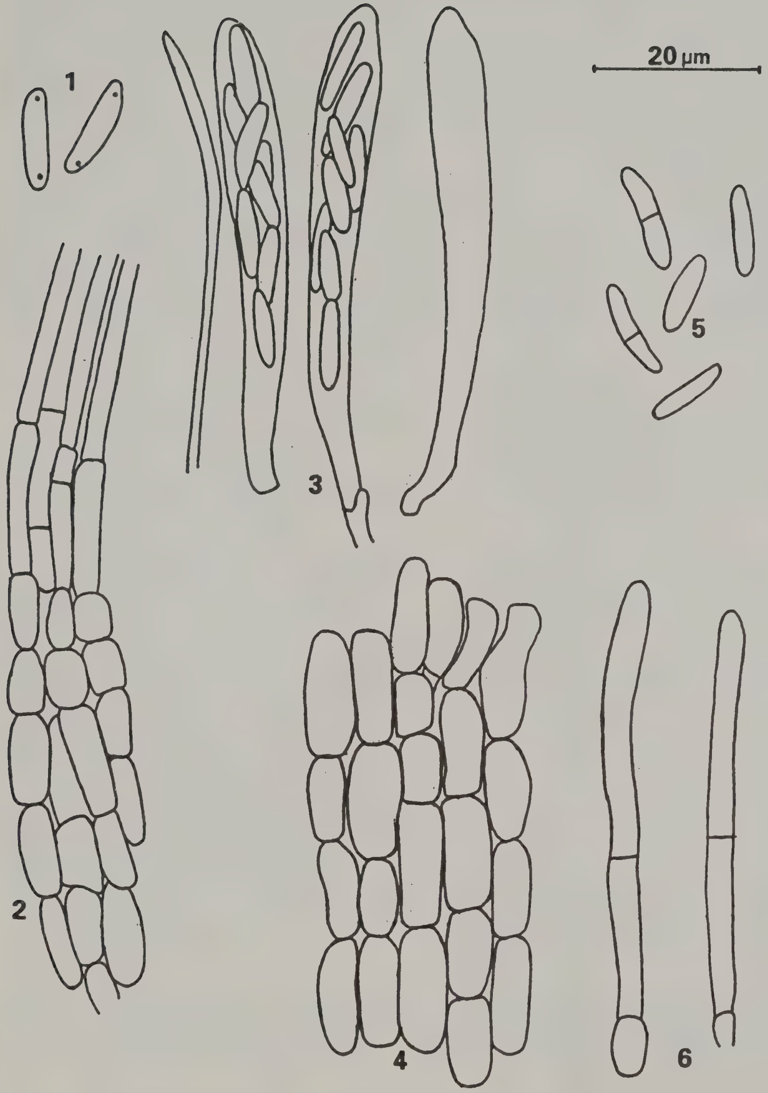
Material and methods

The specimens were collected by R. Galán & M. Lizárraga. Dried material was studied by both authors , using tap water, KOH 2%, Melzer's reagent (MLZ), Cotton blue (CB), and Congo red (CR) for microscopical observations. The photomicrographs were taken by R. Galán using a Nikon Labophot-2 phase-contrast microscope providing magnification up to 1,250x Line-drawings were made by A. Raitviir using a Nikon Labophot-2 microscope equipped with a drawing-tube. The material is deposited in the herbaria **AH** (Alcalá University) and **TAA** (Institute of Zoology and Botany, Tartu).

Taxonomic part

Psilachnum opuntiae R. Galán & Raitviir sp. nov. (Figs. 1- 12)

Apothecia superficilia, substipitata vel breviter stipitata, 0.2-0.4 mm diametro, disco albido, extus primo albido dein brunnescentia, margine breviter albopilosa. Pili cylindracei, hyalini, 1-2-septati, tenuiter tunicati, glabrae, 70-90 x 2.5-3(-4) µm. Excipulum ectale ex textura prismatica compositur. Asci uncinati, cylindraceo-clavati, octospori, poro iodo caerulescentia, substipitati 57-72 x 6.8-7.4 µm vel astipitati 42-52 x 5-7.2 µm in apotheciis



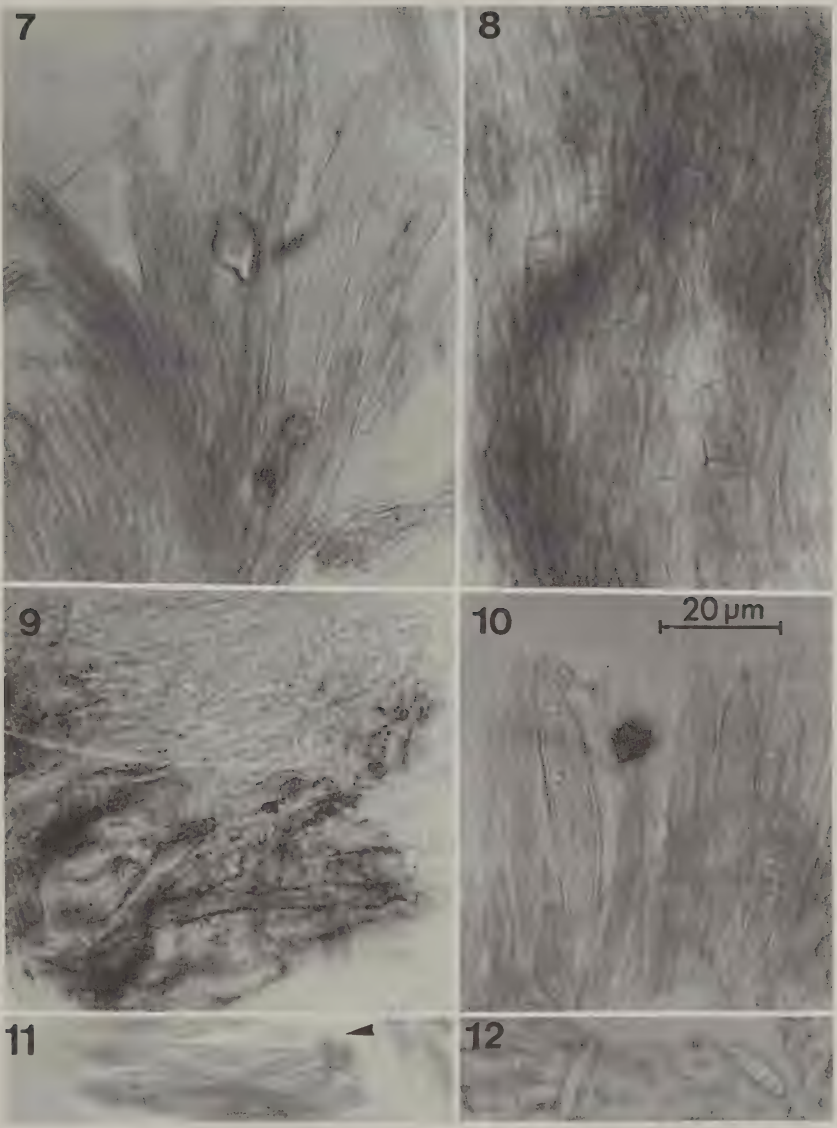
Figs. 1-6: ***Psilachnum opuntiae*****.** 1. Two spores in KOH; 2. A section of the ectal excipulum in CB; 3. Three asci and a paraphysis in MLZ; 4. Excipular cells in KOH; 5. Free spores in MLZ; 6. Two hairs in KOH.

diversis. Sporae cylindraceo-ellipsoideae usque ad allantoideae, raro sigmoideae, biguttulatae, primo aseptatae dein uniseptatae, 10-13.6 x 2.5-3.2 µm. Paraphyses cylindraceae vel sublanceolatae, ascos non superantes, simplicibus vel furcatis ad basim, 1.2-1.6 µm.

Holotypus : In sceleto sicco plantae putridae Opuntiae sp., Las Chichihuas, Ensenada, Baja California, Mexico, R. Galán & M. Lizárraga, 01. II 1996, AH 7056.

Apothecia superficial, solitary or scattered, substipitate to shortly stipitate. Disc 0.2-0.4 mm in diam., whitish. Receptacle cup shaped, almost white when young, brownish when old, covered on the flanks by sparse adpressed white hairs and having a whitish marginal fringe of short hairs frequently agglutinated into groups. Stipe cylindrical, shorter than the diameter of disc, hairless. Marginal hairs cylindrical, apically not swollen, with rounded tips, hyaline, thin-walled, smooth , 1-2-septate, 70-90 x 2.5-3(-4) µm. Hairs on the flanks adpressed, similar to the marginal hairs but shorter, 40-60 µm long. Ectal excipulum composed of *textura prismatica*, cells with thin hyaline walls, 8-15 x 5-7 µm. Outer surface of excipulum covered with granules of a golden brown encrusting matter, incidentally deposited also on the hairs, which is more abundant in older specimens. Asci arising from croziers, cylindric-clavate, 8-spored, apical pore strongly blue in MLZ, indistinctly stalked (57-72 x 6.8-7.4 µm) or sessile (42-52 x 5-7.2 µm) depending on the selected apothecium. Spores irregularly biseriate, cylindric-ellipsoid to allantoid, rarely even sigmoid, with two minute polar lipid bodies (visible in KOH), at first aseptate, but becoming regularly uniseptate when mature, 10-13.6 x 2.5-3.2 µm. Paraphyses cylindrical to obscurely sublanceolate, equalling or scarcely exceeding the asci, basally branched, 1.2-1.6 µm wide.

Specimens examined : On skeletons of decayed cladodes of *Opuntia* (subgenus *Platyopuntia*) sp. (c.f. *O. ficus-indica*), Las Chichihuas, Ensenada, Baja California, Mexico, R. Galán & M. Lizárraga, 01. II 1996, AH 7056 (holotype), TAA 165430 (isotype).



Figs. 7- 12 : ***Psilachnum opuntiae.***.7. Marginal hairs in CR; 8. Front view of the ectal excipulum in KOH; 9. Hairs and excipular cells covered by encrusting matter in MLZ; 10. Hymenium in CR; 11. Abnormal tetrasporig ascus showing the basal crozier (arrow) in CR; 12. Two free spores in tap water. The scale bar in fig. 10 is relevant to figs 7-12.

Discussion

This cacticolous discomycete, characterized by cylindrical, septate, smooth hairs, cylindrical to sublanceolate paraphyses and thin-walled prismatic excipular cells, is best placed in the genus *Psilachnum* Höhn.. It has paraphyses less conspicuous than the majority of *Psilachnum* species but the common species *P. chrysostigmum* (Fr.) Raitv., growing on ferns, also has narrow and short paraphyses. The species is ecologically very interesting as it occurs in very arid areas with insufficient moisture to grow and it is very probably specialized to grow on such a peculiar substrate as a cactus skeleton.

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CERCOSPOROID FUNGI FROM BRAZIL. 3.

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ABSTRACT

The present paper treats several cercosporoid specimens collected in Brazil, and reported by Viégas (1945) as new records of *Cercospora* spp. for this country. Ten specimens representing different Brazilian records are treated, and new combinations and names are proposed in *Mycovellosiella*, *Passalora* and *Pseudocercospora*. New combinations are also proposed to rectify the nomenclature of *Pseudocercospora* spp. described from *Aspidosperma* and *Richardsonia* in Brazil. Furthermore, several specimens from other countries were also examined, and new taxa proposed in several genera including *Phaeoramularia* and *Scolecostigmina*.

INTRODUCTION

The most significant treatments of cercosporoid fungi from Brazil were those of Viégas (1945) and Chupp (1954). In these studies, a relatively broad generic concept of *Cercospora* Fresen. was employed, and species with hyaline and pigmented structures, single or catenulate conidia, and different conidial hila, were all retained in *Cercospora*. This concept has in recent years been re-evaluated, and nearly 50 segregate genera are now distinguished from *Cercospora sensu lato* based on a combination of factors including conidium and conidiophore morphology, pigmentation, type of conidioma, presence or absence of superficial mycelium, and nature of the conidial hila and abscision scars on the conidiogenous cells (Braun, 1995, 1998). The present study gives an account of several Brazilian cercosporoid species that are lodged at the Herbário da Seção de Fitopatologia, Instituto Agronômico, Campinas (IACM), as well as type specimens lodged at other herbaria that were compared to the Brazilian material.

SPECIES TREATED BY HOST

Aspidosperma macrocarpon C. Mart.

1. *Pseudocercospora aspidospermatis* (Batista, Peres & Garnier) J.C. Dianese & M.P.S. Câmara comb. nov.

≡ *Bactrodesmiella aspidospermatis* Batista, Peres & Garnier, Inst. Micol. Univ. Recife. Public. 343: 9. 1961.

≡ *Pseudocercospora aspidospermatis* (Batista, Peres & Garnier) J.C. Dianese & M.P.S. Câmara, Sydowia 46: 225. 1994, *nom. inval.*, Art. 33.2.

Specimen: Brazil, on leaves of *Aspidosperma macrocarpon*, (Apocynaceae), Heringer, 15 Sept. 1960, IMUR 15164 (holotype).

The morphology of this fungus was discussed in detail by Dianese & Câmara (1994).

Croton L. spp.

Numerous cercosporoid taxa are known from *Croton*, including *C. capitati* Tharp, *C. crotonicola* Ellis & Barth., *C. crotonifolia* Cooke, *C. crotonis-oligandri* J.M. Yen & Gilles, *C. crotoniphila* var. *aciculispora* Batista & Bezerra, *C. manaosensis* Henn., *C. maritima* Tracy & Earle, *C. tiglii* Henn., *C. trinidadensis* Stev. & Solh., *Mycovellosiella rubida* (A.S. Mull. & Chupp) Crous, Alfenas & R.W. Barreto and *Pseudocercospora crotonis* (Ellis & Everh.) Deighton. Type specimens for many of these were examined and are discussed below. The holotype of *C. capitati* (BPI 434135) was examined, and found to be a good species of *Cercospora*. No material of *C. crotoniphila* var. *aciculispora* (URM) could be obtained for examination. The type of *C. crotonicola* was not found at NY, BPI or K.

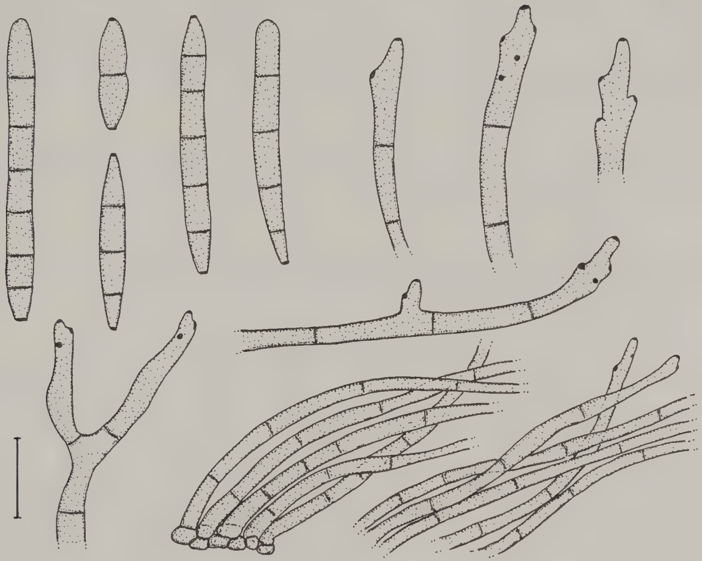


Fig. 1. Catenulate conidia, superficial mycelium and conidiophores of *Mycovellosiella manaosensis*. Bar = 20 µm.

2. *Mycovellosiella manaosensis* (Henn.) U. Braun, Crous & Alfenas comb. nov. Fig. 1

≡ *Cercospora manaosensis* Henn., Hedwigia 43: 395. 1904.

Leaf spots amphigenous, subcircular, 0.5-1.5 mm diam., or indistinct, olivaceous to dull violaceous, margin indefinite. *Colonies* hypophyllous, effuse, olivaceous. Stromata variable, 30-150 µm diam., sometimes confluent and even larger, often elongated, flat, brown. *Mycelium* internal. *Conidiophores* numerous, in dense fascicles, arising from stromata, erect to decumbent, intertwined, decumbent conidiophores developing into creeping secondary hyphae, conidiophores simple or branched, subcylindrical, subclavate, geniculate-sinuous, 25-200 x 2-7 µm, pluriseptate, subhyaline, pale to medium olivaceous brown, in mass fairly dark, smooth; conidiogenous cells integrated, terminal, intercalary or pleurogenous, creeping hyphae often with solitary lateral conidiogenous cells or conidiophores; conidial scars thickened and darkened, 1.5-2.5 µm diam., often numerous, aggregated. Conidia solitary to catenate, occasionally in branched chains, subcylindrical to fusoid, 20-90 x 3-8 µm, (0-)1-7-septate, pale olivaceous to yellowish brown, ends obconically truncate to rounded; hila thickened and darkened.

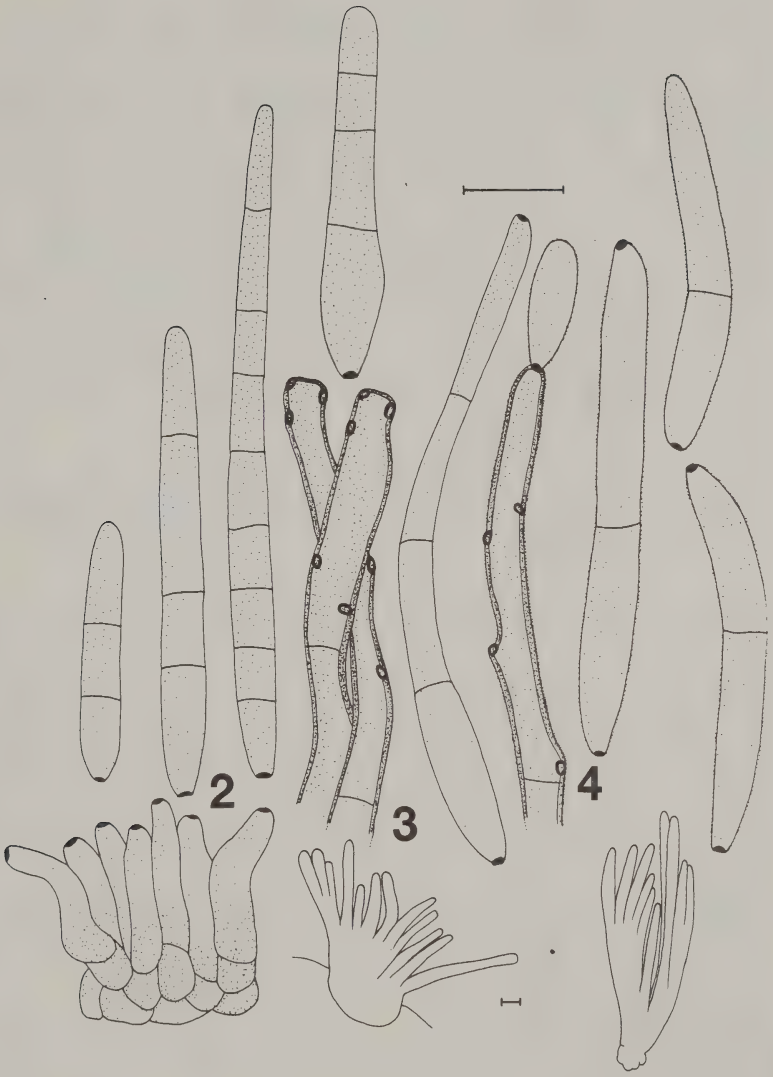
Specimen: Brazil, Rio Negros, Manáos, on *Croton* sp. (Euphorbiaceae), II. 1901, E. Ule 3046, HBG (lectotype).

3. ***Passalora crotonifolia*** (Cooke) Crous, U. Braun & Alfenas comb. nov. Fig. 2

≡ *Cercospora crotonifolia* Cooke, Grevillea 12: 31. 1883.

Leaf spots amphigenous, subcircular to circular, 2-4 mm diam., grey to pale brown, border raised, with a thin dark brown margin. *Mycelium* internal, composed of smooth, branched, hyaline hyphae, 2-3 µm diam. *Caespituli* amphigenous, brown on leaves, up to 50 µm wide and 30 µm high. *Conidiophores* aggregated in dense fascicles, arising from the upper cells of a brown stroma up to 40 µm wide and 20 µm high; conidiophores smooth, subcylindrical, 0-1-septate, pale brown, straight to once geniculate, unbranched, 9-30 x 3.5-5 µm. *Conidiogenous cells* terminal, unbranched, pale brown, smooth, tapering to obtuse apices with darkened, thickened, refractive conidial scars, proliferating sympodially, 9-17 x 3.5-4.5 µm. *Conidia* solitary, pale brown, smooth, subcylindrical to narrowly obclavate, apex obtuse, base obconically truncate, straight, (1-)3(-8)-septate, 30-65 x 3.5-5 µm; hila thickened, darkened throughout, refractive.

Specimen: U.S.A., Aiken, S. Carolina, on leaves of *Croton grandulosus* L., H.W. Ravenel - Fungi Americani Exsiccati No. 593, BPI 435277 (lectotype chosen here).



Figs 2-4. Conidiophores and conidia of *Passalora crotonifolia* (Fig. 2), *Phaeoramularia crotonis* (Fig. 3) and *Phaeoramularia maritima* (Fig. 4). Bars = 10 μm.

4. *Phaeoramularia crotonis* (Ellis & Everh.) Crous, U. Braun & Alfenas comb. nov. Fig. 3

≡ *Cercospora crotonis* Ellis & Everh., Proc. Acad. Sci. Phila. 45: 170. 1893.

≡ *Pseudocercospora crotonis* (Ellis & Everh.) Deighton, Mycol. Pap. 140: 142. 1976.

Leaf spots indistinct. *Mycelium* internal, composed of smooth, branched, hyaline hyphae, 2-3 µm diam. *Caespituli* predominantly hypophyllous, brown on leaves, up to 40 µm wide and 100 µm high. *Conidiophores* aggregated in loose fascicles, arising from the upper cells of a substomatal, brown stroma, up to 30 µm wide and 20 µm high; conidiophores pale brown, smooth, subcylindrical, 3-5-septate, straight to variously curved, unbranched, 50-90 x 4.5-6 µm. *Conidiogenous cells* terminal, unbranched, pale brown, smooth, tapering to rounded apices with flattened, thickened, darkened, refractive conidial scars, proliferating sympodially, 25-35 x 3.5-6 µm. *Conidia* catenulate, chains simple or branched, pale brown, smooth, obclavate, apex subobtuse to obtuse, base obconically truncate, straight to curved, 2-8-septate, 25-120 x 5-7 µm; hila darkened, refractive, thickened.

Specimen: U.S.A., Brockport, Kansas, on leaves of *Croton texensis*, E. Bartholomew No. 359, 15 Aug. 1889, BPI 435283 (lectotype chosen here).

The location of the herbarium of Dr. Yen is unknown to us, but his illustration of *C. crotonis-oligandri* (Yen, 1971) clearly represents a species of *Phaeoramularia* that lacks superficial mycelium, has thickened scars, catenate, 1-3-septate, hyaline conidia, 14-22 x 2-3 µm, and pigmented conidiophores. A new combination is therefore proposed below:

5. *Phaeoramularia crotonis-oligandri* (J.M. Yen & Gilles) Crous, U. Braun & Alfenas, comb. nov.

≡ *Cercospora crotonis-oligandri* J.M. Yen & Gilles, Cah. Maboke 9: 102. 1971.

6. *Phaeoramularia maritima* (Tracy & Earle) Crous, U. Braun & Alfenas comb. nov. Fig. 4

≡ *Cercospora maritima* Tracy & Earle, Bull. Torrey Bot. Club 22: 179. 1895.

Leaf spots indistinct. *Mycelium* internal, composed of smooth, branched, hyaline hyphae, 3-4 µm diam. *Caespituli* amphigenous, brown on leaves, up to 50 µm wide and 150 µm high. *Conidiophores* aggregated in dense fascicles, arising from the upper cells of a weakly developed stroma; conidiophores pale brown, finely verruculose, subcylindrical, 3-8-septate, straight to variously curved, unbranched, 50-130 x 5-7 µm. *Conidiogenous cells* terminal, unbranched, olivaceous, finely verruculose, tapering to rounded apices with flattened, thickened, darkened, refractive conidial scars, proliferating sympodially, 15-30 x 5-6 µm. *Conidia* catenulate, chains simple, pale brown, finely verruculose, narrowly obclavate, apex obtuse, base obconically truncate, straight to slightly curved, 1-5-septate, 30-100 x 4-7 µm; hila darkened, refractive, thickened.

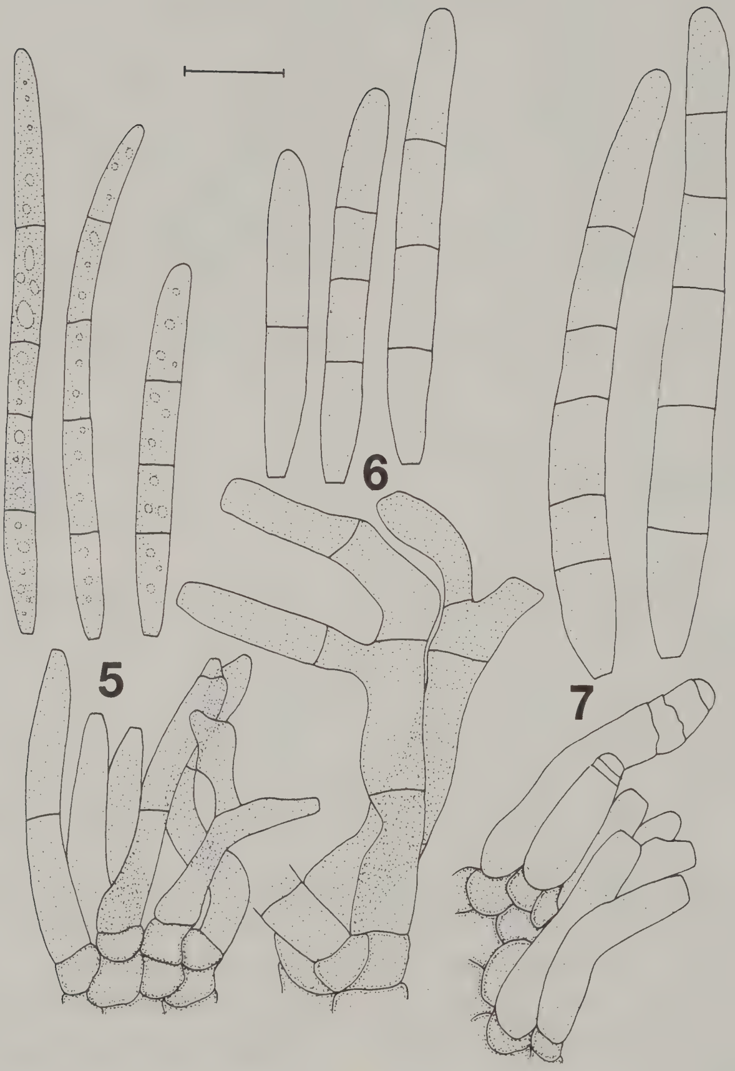
Specimen: U.S.A., Mass., Horn Island, on leaves of *Croton maritimus*, 31 Mar. 1892, F.S. Earle, BPI 438113 (holotype), BPI 438112, 438114 (isotypes).

7. ***Pseudocercospora crotoniphila*** (Speg.) Crous, U. Braun & Alfenas comb. nov. Fig. 5

≡ *Cercospora crotoniphila* Speg., Bol. Acad. Nac. Ciencias, Cordoba (Arg.) 23: 528. 1919.

Leaf spots epiphyllous, circular, 2-3 mm diam., inconspicuous to pale brown. *Mycelium* internal, composed of smooth, branched, pale brown hyphae, 3-4 µm diam. *Caespituli* epiphyllous, brown to black on leaves, up to 40 µm wide and 40 µm high. *Conidiophores* aggregated in dense fascicles, arising from the upper cells of a brown stroma up to 30 µm wide and 15 µm high; conidiophores pale brown, smooth, subcylindrical, 0-2-septate, straight to geniculate-sinuous, unbranched or branched above, 20-40 x 4-5 µm. *Conidiogenous cells* terminal, unbranched, pale brown, smooth, tapering to truncate apices, proliferating sympodially, 10-25 x 3-4 µm. *Conidia* solitary, olivaceous, smooth, guttulate, narrowly obclavate to subcylindrical, apex subobtuse, base obconically truncate, straight to curved, 2-6-septate, 20-90 x 3-5 µm; hila inconspicuous.

Specimen: Brazil, São Paulo, Cerrado, on leaves of *Croton* sp., (Euphorbiaceae), A.P. Viégas, 28 Feb. 1941, IACM 3721.



Figs 5-7. Conidophores and conidia of *Pseudocercospora crotoniphila* (Fig. 5), *P. tiglii* (Fig. 6) and *P. trinadensis* (Fig. 7). Bar = 10 µm.

This specimen was reported from Brazil by Viégas (1945) as *Cercospora crotoniphila*. Although the type specimen of *C. crotoniphila* (in LPS) could not be obtained for re-examination, the morphological characteristics and dimensions agree perfectly with that of the original description, and therefore a new combination is proposed.

8. ***Pseudocercospora tiglii*** (Henn.) Crous, U. Braun & Alfenas comb. nov. Fig. 6

≡ *Cercospora tiglii* Henn., Hedwigia 47: 265. 1908.

Leaf spots amphigenous, subcircular to irregular, 2-6 mm diam., pale to dark brown. *Mycelium* internal and external, composed of smooth, branched, pale brown hyphae, 3-4.5 µm diam. *Caespituli* predominantly hypophyllous, brown on leaves, up to 40 µm wide and 120 µm high. *Conidiophores* aggregated in loose fascicles, arising from the upper cells of a weakly developed, brown stroma; conidiophores pale brown, smooth, subcylindrical, 2-7-septate, straight to variously curved, extensively branched, 40-110 x 4-5 µm. *Conidiogenous cells* terminal, unbranched, olivaceous, smooth, tapering to flat-tipped apices, proliferating sympodially, 15-40 x 4-5 µm. *Conidia* solitary, olivaceous, smooth, guttulate, subcylindrical to narrowly obclavate, apex obtuse, base obconically truncate, straight to slightly curved, 3-10-septate, 20-85 x 3.5-5 µm; hila inconspicuous.

Specimen: Philippines, Balut Island, on leaves of *Croton tiglium*, 8 Oct. 1906, E.D. Merrill No. 5423, B (lectotype), BPI 441930 (isolectotype).

9. ***Pseudocercospora trinidadensis*** (F. Stevens & Solheim) Crous, U. Braun & Alfenas comb. nov. Fig. 7

≡ *Cercospora trinidadensis* F. Stevens & Solheim, Mycologia 23: 376. 1931.

Leaf spots amphigenous, angular, 1-3 mm diam., dark brown, surrounded by a wide chlorotic margin. *Mycelium* internal, composed of smooth, branched, hyaline hyphae, 2.5-3.5 µm diam. *Caespituli* predominantly hypophyllous, brown on leaves, up to 70 µm wide and 40 µm high. *Conidiophores* aggregated in dense fascicles, arising from the upper cells of a pale brown stroma, up to 40 µm wide and 20 µm high; conidiophores reduced to conidiogenous cells, rarely with one supporting cell. *Conidiogenous cells* unbranched, olivaceous to pale brown, smooth to finely verruculose, tapering to flat-tipped or rounded apices, proliferating sympodially, rarely percurrently, 15-25 x 4-5 µm. *Conidia* solitary, olivaceous, smooth, narrowly obclavate, apex obtuse, base obconically truncate, straight to slightly curved, 3-6-septate, 40-70 x 5-6 µm; hila inconspicuous.

Specimen: Trinidad, St. Augustine, on leaves of *Croton gossypiifolius*, 13 Aug. 1922, F.L. Stevens No. 839, BPI 442019 (holotype).

Chupp (1954) regarded *P. trinidadensis* to be synonymous with *P. tiglii*, stating that although the conidiophores were shorter in the former, other collections showed a gradient between the two species. Conidia of the two species are similar in shape, but several other characters separate them. *P. trinidadensis* produces characteristic small, dark brown, angular lesions with wide chlorotic margins that are absent in the type of *P. tiglii*. *P. trinidadensis* also lacks superficial mycelium, and does not have long, extensively branched conidiophores as is characteristic of *P. tiglii*. Based on these features, the two taxa should be retained as separate species.

Diodia teres Walter

10. *Passalora diodiae* (Cooke) Crous, U. Braun & Alfenas comb. nov. Fig. 8

≡ *Cercospora diodiae* Cooke, Grevillea 7: 34. 1878.

Leaf spots amphigenous, circular to indistinct, 0.5-3(-6) mm diam., brown with numerous black, aggregated caespituli. *Mycelium* internal, composed of smooth, branched, hyaline hyphae, 2.5-3.5 µm diam. *Caespituli* amphigenous, black to dark brown on leaves, up to 60 µm wide and 80 µm high. *Conidiophores* aggregated in loose fascicles, arising from the upper cells of a brown stroma up to 35 µm wide and 30 µm high; conidiophores medium brown, finely verruculose, subcylindrical, 1-4-septate, straight to variously curved, unbranched, 30-80 x 4-7 µm. *Conidiogenous cells* terminal, unbranched, medium brown, finely verruculose, tapering to obtuse apices, proliferating sympodially, with thickened, darkened, refractive conidial scars, 15-20 x 4-5 µm. *Conidia* solitary, olivaceous to pale brown, smooth to finely verruculose, subcylindrical to narrowly obclavate, apex subobtuse, base long obconically truncate, straight to variously curved, 1-9-septate, 25-130 x 3-4.5 µm; hila thickened, darkened throughout, refractive.

Specimens: U.S.A., Aiken, S. Carolina, on leaves of *Diodia teres,* (Rubiaceae), H.W. Ravenel – Fungi Americani Exsiccati No. 2284 (585), BPI 435742 (lectotype chosen here); Brazil, São Paulo, Campinas, on leaves of *Diodia teres*, A.P. Viégas, 23 Feb. 1934, IACM 398.

The morphological variation observed within the Brazilian specimen corresponded well with that of the type specimen of *Passalora diodiae*.

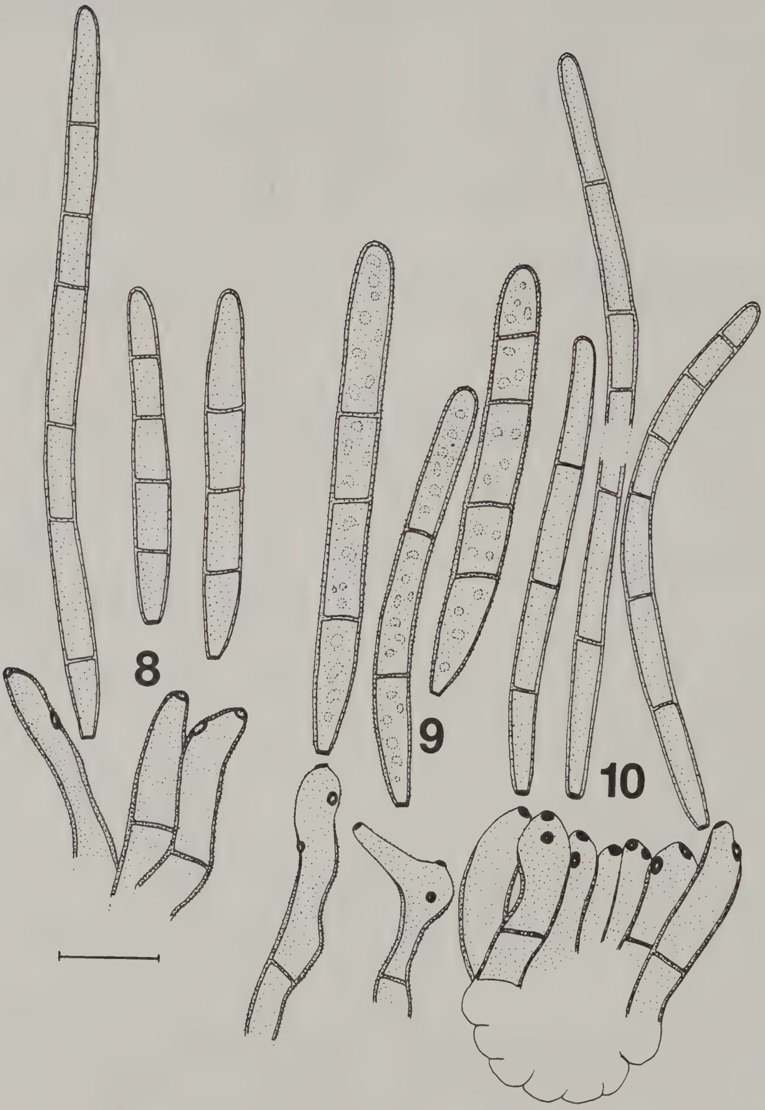
***Mucuna pruriens* var. *utilis* (Wall. ex Wright) Baker ex Burck (= *M. utilis* Wall. ex Wight)**

11. *Passalora mucunicola* Crous, U. Braun & Alfenas sp. nov.

Fig. 9

Maculae amphigenae, irregulares vel suborbiculares, 1-5 mm diam., modice brunnea, margine lenissime elevato, atro-brunneo cinctae. Mycelium immersum; hyphae leves, ramosae, hyalinae, 2.5-3.5 µm latae. Caespituli amphigeni, modice brunnei, ad 70 x 100 µm. Conidiophora subtiliter verruculosa, 1-3-septata, subcylindrica, modice brunnea, recta vel leviter curvata, non-ramosa, 30-60 x 4-6 µm. Cellulae conidiogenae terminales, non-ramosae, dilute brunneae, leves vel subtiliter verruculosae, subcylindricae, recta, raro geniculatae, apicem versus attenuatae, apice truncata vel rotundata, cum locis fuscatis, incrassatis, refractivis, sympodiales, 15-25 x 4-6 µm. Conidia solitaria, olivacea vel pallide brunnea, leves vel subtiliter verruculosa, subcylindrica, apice obtusa, basi obconice truncata, recta vel curvata, (1-)4-7(-16)-septata, 25-160 x 3-5 µm; hila incrassata, fuscata, refractiva.

Leaf spots amphigenous, irregular to subcircular, 1-5 mm diam., medium brown, with a slightly raised, dark brown border. *Mycelium* internal, composed of smooth, branched, hyaline hyphae, 2.5-3.5 µm diam. *Caespituli* amphigenous, medium brown on leaves, up to 70 µm wide and 100 µm high. *Conidiophores* aggregated in loose fascicles, arising from the upper cells of a brown stroma up to 60 µm wide and 40 µm



Figs 8-10. Conidiophores and conidia of *Passalora diodiae* (Fig. 8), *P. mucunicola* (Fig. 9) and *P. sidae-cordifoliae* (Fig. 10). Bar = 10 µm.

high; conidiophores finely verruculose, 1-3-septate, subcylindrical, medium brown, straight to slightly curved, unbranched, 30-60 x 4-6 µm. *Conidiogenous cells* terminal, unbranched, pale brown, smooth to finely verruculose, subcylindrical, straight, rarely geniculate, tapering to truncate or bluntly rounded apices with darkened, thickened, refractive conidial scars, proliferating sympodially, 15-25 x 4-6 µm. *Conidia* solitary, olivaceous to pale brown, smooth to finely verruculose, subcylindrical, apex obtuse, base obconically truncate, straight to curved, (1-)4-7(-16)-septate, 25-160 x 3-5 µm; hila thickened, darkened throughout, refractive.

Specimen: Brazil, São Paulo, Campinas, on leaves of *Mucuna pruriens* var. *utilis* (Fabaceae), A.S. Costa & H.P. Krug., 27 Jun. 1935, IACM 3026 (holotype).

The present specimen was recorded as *Cercospora stizolobii* Syd. & P. Syd. [≡ *Pseudocercospora stizolobii* (Syd. & P. Syd.) Deighton] by Viégas (1945). The thickend conidial hila, however, exclude this species from *Pseudocercospora*. A few *Passalora* species are known from *Mucuna*, namely *P. mucunae* (Syd. & P. Syd.) U. Braun & Mouch., *P. mucunae* var. *denticulata* U. Braun & Mouch., and *P. sojina* (Hara) H.D. Shin & U. Braun (Shin & Braun, 1996; Braun, Mouchacca & McKenzie, 1999). *P. mucunicola* is distinct from *P. mucunae* by having short, 1-3-septate conidiophores, whereas those of *P. mucunae* are pluriseptate, up to 500 µm long. It is furthermore distinguished from *P. sojina* (conidia 20-80 x 4-8 µm, conidiophores 40-200 x 4-6.5 µm) by its longer conidia, and shorter conidiophores.

Polygonum punctatum Elliott (= *P. acre* Kunth, *nom. illeg.*)

12. *Passalora effusa* (Berk. & M.A. Curtis) U. Braun, Mycotaxon 55: 231. 1995.

≡ *Cladosporium effusum* Berk. & M.A. Curtis, Grevillea 3: 106. 1875.

≡ *Cercospora effusa* (Berk. & M.A. Curtis) Ellis, J. Mycol. 1: 53. 1885.

≡ *Didymaria effusa* (Berk. & M.A. Curtis) Solheim, Ill. Biol.

Monogr. 12: 65. 1930.
= *Cercospora polygonorum* Cooke, Hedwigia 17: 39. 1878.
≡ *Pseudocercospora polygonorum* (Cooke) Y.L. Guo & X.J. Liu, Mycosystema 4: 110. 1991.
= *Helminthosporium hydropiperis* Thüm., Rev. Mycol. 1: 60. 1879.
≡ *Cercospora hydropiperis* (Thüm.) Speg., Bol. Acad. Cien. Cordoba 9: 191. 1880.

Leaf spots hypophyllous, irregular, 1-5 mm diam., pale yellow on upper surface, dark brown on lower surface due to spore masses, borders indistinct. *Mycelium* internal, composed of smooth, branched, hyaline hyphae, 2.5-3.5 µm diam. *Caespituli* hypophyllous, brown on leaves, up to 180 µm wide and 90 µm high. *Conidiophores* aggregated in dense fascicles, arising from the upper cells of a brown stroma up to 40 µm wide and 30 µm high; conidiophores pale brown, finely verruculose, subcylindrical, 2-7-septate, straight to variously curved, unbranched, 30-120 x 6-8 µm. *Conidiogenous cells* terminal, unbranched, pale brown, finely verruculose, tapering to rounded apices, proliferating sympodially, with numerous, aggregated, thickened, darkened, refractive conidial scars, 15-40 x 5-7 µm. *Conidia* solitary, pale brown, finely verruculose, subcylindrical to clavate, apex obtuse, base truncate to long obconically truncate, straight to slightly curved, 1-5-septate, 28-60 x 7-8 µm; hila thickened, darkened throughout, refractive.

Specimen: Brazil, Rio de Janeiro, on leaves of *Polygonum punctatum*, (Polygonaceae), J. Deslandes, 17 Sept. 1940, IACM 3612.

The present specimen was treated as representative of *Cercospora polygonorum* by Viégas (1945). The Brazilian specimen closely fits the morphological variation accepted to occur in this taxon.

Richardsonia glabra A. St.-Hil.

13. *Pseudocercospora carveriana* (Sacc. & D. Sacc.) Crous & M.P.S. Câmara comb. nov.

≡ *Cercospora carveriana* Sacc. & D. Sacc., Syll. Fung. 18: 607. 1906.
= *Cercospora richardsoniae* Ellis & Everh., J. Mycol. 8: 72. 1902 (June 30), (homonym of *C. richardsoniae* Henn., June 23, 1902).

≡ *Pseudocercospora richardsoniae* Crous & M.P.S. Câmara, Mycotaxon 68: 304. 1998.

Specimen: USA, Tuskegee, Ala., on *Richardsonia glabra* (Rubiaceae), G.W. Graver, 31 Aug. 1900, Ellis & Everhart's Fungi Columbiani No. 1612, BPI 440390 (lectotype), BPI 440389 (isolectotype).

Crous & Câmara (1998) discussed two cercosporoid species that were described from *Richardsonia* with the same epithet, namely *Cercospora richardsoniae* Ellis & Everh. (1902) from the USA, and *Cercospora richardsoniae* Henn. (1902) from Brazil. Saccardo (1906) proposed a new name for the species described by Ellis & Everhart, namely *C. carveriana* Sacc. & D. Sacc. However, there was a typographical error, and Jan. 1902 was printed instead of June 30 1902. As indicated above, the Hennings name predates that of Ellis & Everhart. *P. richardsoniicola* Crous & M.P.S. Câmara was introduced as a new name for *C. richardsoniae* Henn., and remains valid, since the epithet "*richardsoniae*" is preoccupied in *Pseudocercospora*. The combination proposed in *Pseudocercospora* for *C. richardsoniae* Ellis & Everh. was thus based on a homonym, and is invalid, but has to be considered now as a new name in *Pseudocercospora* (ICBN Art. 72). A new combination in *Pseudocercospora* is required, therefore, for *C. carveriana* Sacc. & D. Sacc., which is the new name that was originally proposed for the homonym, *C. richardsonia* Ellis & Everh.

Sida cordifolia L.

14. *Passalora sidae-cordifoliae* Crous, U. Braun & Alfenas sp. nov. Fig. 10

Maculae amphigenae, suborbiculares vel orbiculares, 2-6 mm diam., dilute vel modice brunneae, margine elevato, brunneo cinctae. Mycelium immersum; hyphae leves, ramosae, hyalinae vel dilute brunneae, 3-4 µm diam. Caespituli epiphylli, brunnei, ad 40 x 45 µm. Conidiophora dense fasciculata, ex cellulis stromatibus oriunda; stromata ad 40 x 20 µm; conidiophora dilute brunnea, leves, subcylindrica, 0-2-septata, recta vel leniter curvata, non-ramosa, 15-30 x 3.5-4.5 µm. Cellulae conidiogenae terminales, non-ramosae, dilute brunneae, leves, apicem versus attenuatae, apice rotundata, sympodiales, cum locis incrassatis, fuscatis, refractivis, 10-20 x 3.5-4 µm. Conidia solitaria, olivacea vel dilute brunnea, leves, subcylindrica, apice obtusa, basi truncata vel longe obconice truncata, recta vel curvata, 2-14-septata, 35-160 x 3-5 µm, hila incrassata, fuscata, refractiva.

Leaf spots amphigenous, subcircular to circular, 2-6 mm diam., pale to medium brown with a raised, brown border. *Mycelium* internal, composed of smooth, branched, hyaline to pale brown hyphae, 3-4 µm diam. *Caespituli* epiphyllous, brown on leaves, up to 40 µm wide and 45 µm high. *Conidiophores* aggregated in dense fascicles, arising from the upper cells of a brown stroma up to 40 µm wide and 20 µm high; conidiophores pale brown, smooth, subcylindrical, 0-2-septate, straight to slightly curved, unbranched, 15-30 x 3.5-4.5 µm. *Conidiogenous cells* terminal, unbranched, pale brown, smooth, tapering to rounded apices, proliferating sympodially, with thickened, darkened, refractive conidial scars, 10-20 x 3.5-4 µm. *Conidia* solitary, olivaceous to pale brown, smooth, subcylindrical, apex obtuse, base truncate to long obconically truncate, straight to curved, 2-14-septate, 35-160 x 3-5 µm; hila thickened, darkened throughout, refractive.

Specimen: Brazil, São Paulo, Pinodorama, on leaves of *Sida cordifolia*, (Malvaceae), H.P. Krug., 16 Mar. 1941, IACM 1939 (holotype).

Viégas (1945) treated this specimen as representative of *Cercospora sidae* (Henn.) Petrak. The type of the latter species has been examined by Braun (1993), and found to be representative of a *Drechslera*/*Exosporium*-like hyphomycete. The type specimen of *Cercospora humulis* Pavgi & U.P. Singh. was examined (IMI 113121), as well as one additional collection from a *Sida* sp. in India (IMI 300123), and both were found to be colonized by a true species of *Cercospora* with hyaline conidia and thickened, darkened, refractive hila. Several other cercosporoid taxa with pigmented conidia are known from *Sida*, including *Mycovellosiella sidarum* (Petr. & Cif.) Deighton, *Pseudocercospora sidae* (Marchal & Steyaert) Deighton and *P. micranthae* (A.S. Mull. & Chupp) Crous, Alfenas & R.W. Baretto. The present species is easily distinguished from the *Pseudocercospora* spp. by having conidia with thickend hila, and from *M. sidarum* by its solitary, larger conidia and the absence of superficial mycelium. The Brazilian collection is therefore described as new.

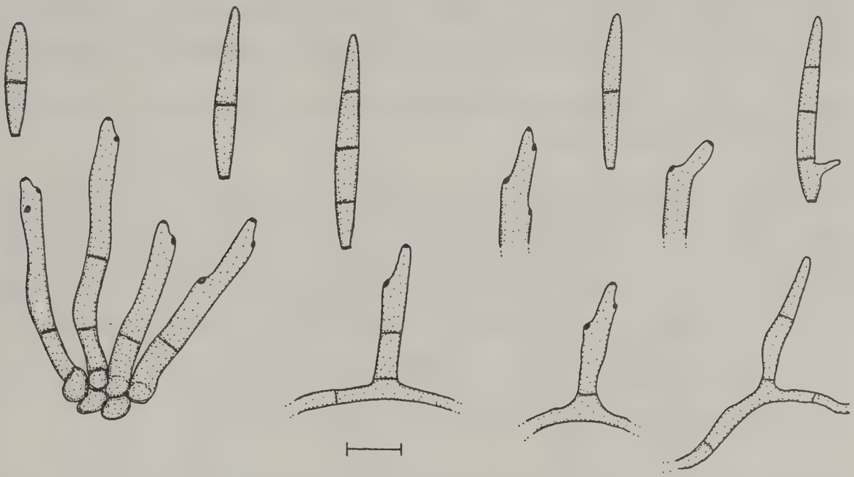


Fig. 11. Conidiophores, mycelium and conidia of *Mycovellosiella duplicans*. Bar = 10 µm.

***Stachytarpheta* sp.**

15. *Mycovellosiella duplicans* (Chupp) U. Braun, Crous & Alfenas comb. nov. Fig. 11

≡ *Cercospora duplicans* Chupp, A Monograph of the Fungus Genus *Cercospora*: 590, Ithaca, New York "1953" (1954).

≡ *C. stachytarphetae* Henn., Hedwigia 48: 18. 1909, non *C. stachytarphetae* Ellis & Everh., 1898.

Leaf spots amphigenous, subcircular, small, reddish brown. Colonies hypophyllous, very scantily effuse. *Mycelium* internal and external, secondary hyphae superficial, creeping, sparsely branched, septate, subhyaline to very pale olivaceous, smooth, 1-3.5 µm wide. Stromata absent or very small, pale brown. *Conidiophores* in small, loose to moderately dense fascicles, arising from small stromata or solitary, arising from secondary hyphae, lateral, erect, straight, subcylindrical, moderately geniculate-sinuous, unbranched, 10-60 x 2-4.5 µm, 0-2-septate, pale olivaceous, smooth. *Conidiogenous cells* integrated, terminal or conidiophores reduced to a single conidiogenous cell, 10-30 x 2-3.5 µm, conidial scars conspicuous, slightly thickened and darkened, 1-2 µm wide. *Conidia* solitary, subcylindrical-obclavate, fusiform, 10-35(-50) x 2-4 µm, 1-3 (-5)-septate, subhyaline, smooth, apex subobtuse or subacute, base obconically truncate; hila slightly thickened and darkened.

Specimen: Brazil, São Paulo, on *Stachytarpheta* sp., Feb. 1903, A. Puttemans 639, IMI 179742 (lectotype).

Based on creeping secondary hyphae with solitary conidiophores and thickened, darkened conidial scars and hila, this species has to be placed in *Mycovellosiella*. Holotype material, deposited in B, has recently been lost. Good slide preparations in IMI, taken from the holotype, represent the only existing original material of this species and are selected to serve as lectotype. *C. stachytarphetae* Ellis & Everh. (Chupp, 1954: 595) is a true *Cercospora s.str.* with colourless acicular conidia.

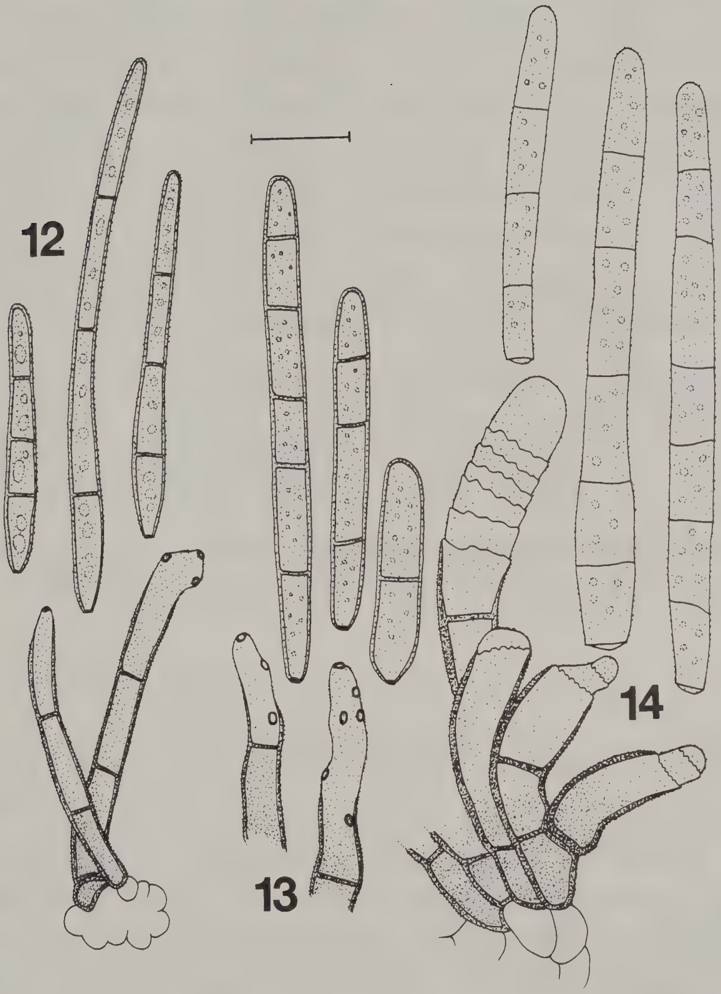
Vernicia fordii (Hemsl.) Airy Shaw (= *Aleurites fordii* Hemsl).

16. *Passalora verniciae* Crous, U. Braun & Alfenas sp. nov.

Fig. 12

Maculae amphigenae, irregulares vel suborbiculares, 3-20 mm diam., modice brunneae, margine indistincto. Mycelium immersum; hyphae leves, ramosae, hyalinae vel dilute brunneae, 3-4 µm diam. Caespituli hypophylli, brunnei, ad 60 µm lati. Conidiophora laxe vel dense fasciculata, ex cellulis stromatibus oriunda, stromata ad 60 x 40 µm, vel ex cellulis spermogoniis gerentes; conidiophora subtiliter verruculosa, subcylindrica, 0-3-septata, modice brunnea, recta vel geniculata-sinuosa, non-ramosa vel ramosa, 20-40 x 3.5-4 µm. Cellulae conidiogenae terminales, non-ramosae, pallide brunneae, leves vel subtiliter verruculosae, apicem versus attenuatae, apice rotundata, cum locis fuscatis, incrassatis, refractivis, sympodiales, 10-20 x 3-4 µm. Conidia solitaria, pallide brunnea, subtiliter verrucuosa, guttulata, anguste obclavata vel subcylindrica, apice subobtusa, basi obconice truncata, recta vel curvata, 1-3-septata, 25-45 x 3-3.5 µm, hila incrassata, fuscata, refractiva.

Leaf spots amphigenous, irregular to subcircular, 3-20 mm diam., medium brown with an indistinct border. *Mycelium* internal, composed of smooth, branched, hyaline to pale brown hyphae, 3-4 µm diam. *Caespituli* hypophyllous, brown on



Figs 12-14. Conidia and conidiophores of *Passalora verniciae* (Fig. 12), *P. yuccae-gloriosae* (Fig. 13) and *Scolecostigmina yuccae* (Fig. 14). Bar = 10 µm.

leaves, up to 60 µm wide. *Conidiophores* aggregated in loose to dense fascicles, arising from the upper cells of a brown stroma up to 60 µm wide and 40 µm high, or situated on the outer layer of spermatogonia; conidiophores finely verruculose, subcylindrical, 0-3-septate, medium brown, straight to geniculate-sinuous, unbranched or branched above, 20-40 x 3.5-4 µm. *Conidiogenous cells* terminal, unbranched, pale brown, smooth to finely verruculose, tapering to rounded apices with darkened, thickened, refractive conidial scars, proliferating sympodially, 10-20 x 3-4 µm. *Conidia* solitary, pale brown, finely verruculose, guttulate, narrowly obclavate to subcylindrical, apex subobtuse, base obconically truncate, straight to curved, 1-3-septate, 25-45 x 3-3.5 µm; hila thickened, darkened throughout, refractive.

Specimen: Brazil, São Paulo, on leaves of *Vernicia fordii* (Euphorbiaceae), P.T. Mendes, 28 Nov. 1937, IACM 2125 (holotype).

This specimen was reported from Brazil as *Cercospora aleuritis* Miyake [=*Pseudocercospora aleuritis* (Miyake) Deighton] by Viégas (1945). However, the thickened conidial hila clearly exclude this species from *Pseudocercospora*. The single conidia, and absence of superficial mycelium suggest that it would be better accommodated in *Passalora*. No other species of *Passalora* are known from *Aleurites*, and therefore this collection is described as new.

Yucca L. spp.

17. *Passalora yuccae-gloriosae* Crous, U. Braun & Alfenas sp. nov. Fig. 13

Maculae amphigenae, suborbiculares, 1-5 mm diam., dilute brunneae, cum zona atro-brunnea, margine tenui, rubro-brunneo cinctae. Mycelium immersum; hyphae leves, ramosae, dilute brunneae, 3-4 µm latae. Caespituli amphigeni, atro-brunnei, ad 200 x 130 µm. Conidiophora dense fasciculata, ex cellulis stromatibus oriunda; stromata atro-brunnea, ad 180 x 60 µm; conidiophores subtiliter verruculosa, subcylindrica, 2-5-septata, dilute brunnea, recta vel geniculata-sinuosa, non-ramosa, 40-65 x 3.5-6.5 µm. Cellulae conidiogenae terminales, non-ramosae, pallide brunneae, subtiliter verruculosae, apicem versus attenuatae, apice subobtusa, cum locis fuscatis, incrassatis, refractivis, sympodiales, 15-22 x 3.5-5 µm. Conidia solitaria, olivacea vel dilute brunnea, leves, subcylindrica vel obclavata-subcylindrica, apice obtusa, basi obconice truncata, recta vel leniter curvata, (1-)4-6(-10)-septata, (20-)50-90(-160) x (3.5-)4-5(-6) µm, hila incrassata, fuscata, refractiva.

Leaf spots amphigenous, subcircular, 1-5 mm diam., pale brown, with a dark brown border, surrounded by a thin, red-brown margin. *Mycelium* internal, composed of smooth, branched, pale brown hyphae, 3-4 µm diam. *Caespituli* amphigenous, dark brown on leaves, up to 200 µm wide and 130 µm high. *Conidiophores* aggregated in dense fascicles, arising from the upper cells of a dark brown stroma up to 180 µm wide and 60 µm high; conidiophores finely verruculose, subcylindrical, 2-5-septate, pale brown, straight to geniculate-sinuous, unbranched, 40-65 x 3.5-6.5 µm. *Conidiogenous cells* terminal, unbranched, pale brown, finely verruculose, tapering to subobtuse apices with darkened, thickened, refractive conidial scars, proliferating sympodially, 15-22 x 3.5-5 µm. *Conidia* solitary, olivaceous to pale brown, smooth, subcylindrical to obclavate-subcylindrical, apex obtuse, base obconically truncate, straight to slightly curved, (1-)4-6(-10)-septate, (20-)50-90(-160) x (3.5-)4-5(-6) µm; hila thickened, darkened throughout, refractive.

Specimen: Brazil, São Paulo, Estrada para Lindoia, Socorro, on leaves of *Yucca gloriosa* var. *recurvifolia* (Agavaceae), A.P. Viégas & O. Zagatto, 20 Sept. 1939, IACM 3108 (holotype).

The present specimen was collected and described by Viégas (1945) as representative of *Cercospora yucca* Cooke. Three cercosporoid species are known from *Yucca* L., namely *C. yucca*, *C. floricola* Heald & F.A. Wolf, and *Cercostigmina concentrica* (Cooke & Ellis) U. Braun. *C. yucca* is reported by Chupp (1954) to have pigmented, 1-3-septate, cylindrical to obclavate-cylindrical conidia, 25-90 x 4-6.5 µm. In a re-examination of the type specimen of *C. yucca*, we found the conidiogenous cells to proliferate percurrently via irregularly dispersed, jagged annellations. Conidia were euseptate, scolecosporous, and the walls of the conidiophores and conidiogenous cells prominantly thickened. This species resembles others accommodated in *Cercostigmina*/*Scolecostigmina*. However, the thickened, verrucose conidiophores and verruculose conidia exclude it from *Cercostigmina* in favour of *Scolecostigmina*.

18. *Scolecostigmina yuccae* (Cooke) Crous, U. Braun & Alfenas comb. nov. Fig. 14

≡ *Cercospora yuccae* Cooke, Grevillea 7: 35. 1878.

Leaf spots amphigenous, oval to elongate, 2-6 x 8-30 mm, pale to medium brown on upper surface, and grey to medium brown on lower surface, border raised, lighter brown, lesions sometimes bulging on upper surface. *Mycelium* internal, composed of smooth, branched, hyaline hyphae, 1.5-2.5 µm diam. *Caespituli* amphigenous, brown on leaves, up to 60 µm wide and high. *Conidiophores* aggregated in dense fascicles, arising from the upper cells of a brown stroma up to 35 µm wide and 25 µm high; conidiophores finely verruculose to verruculose, subcylindrical, 0-6-septate, pale to medium brown, straight to slightly curved, unbranched or branched at base, 15-50 x 5-7 µm. *Conidiogenous cells* terminal, unbranched, pale brown, finely verruculose to verruculose, tapering to rounded apices, proliferating percurrently via several irregular, widely separated annellations, 10-25 x 5-6 µm. *Conidia* solitary, olivaceous to medium brown, guttulate, finely verruculose, subcylindrical to narrowly obclavate, apex subobtuse, base narrowly obconically truncate, straight to slightly curved, 3-6-septate, 25-120 x 4-7 µm; hila inconspicuous.

Specimen: USA, Darien, Georgia, on leaves of *Yucca* sp., H.W. Ravenel – Fungi Americani Exsiccati No. 292, BPI 435122 (lectotype chosen here).

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The authors gratefully acknowledge the assistance of the curators of IACM, HBG and BPI for providing the specimens that formed the basis of this study. Dr. Isabelle Tavares (University of California, Berkeley) is thanked for pointing out the nomenclatural error with the name *Pseudocercospora richardsoniae*. The Department of Plant Pathology/Bioagro at the Federal University of Viçosa is thanked for providing laboratory facilities to the first author during a visit to Brazil, and Eric McKenzie and Joanne Taylor are thanked for reviewing the script.

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A NEW SPECIES OF CALICIOPSIS ON OAKS FROM MEXICO

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ABSTRACT

A *Caliciopsis* found on galls associated with *Callirythis* on living twigs of *Quercus canbyi* in Nuevo León, Mexico is described as a new species. The name *Caliciopsis quercina* is proposed. .

INTRODUCTION

During a survey of forest fungi of interest from Nuevo León, Mexico, an ascomycete was found on galls associated with *Callirythis* (Hymenoptera: Cynipidae) on living twigs of *Quercus canbyi* Trel. The study of this material and its comparison with described species of *Caliciopsis*, showed important differences and based on these differences is herewith described as a new species.

Caliciopsis quercina Marm. sp.nov.

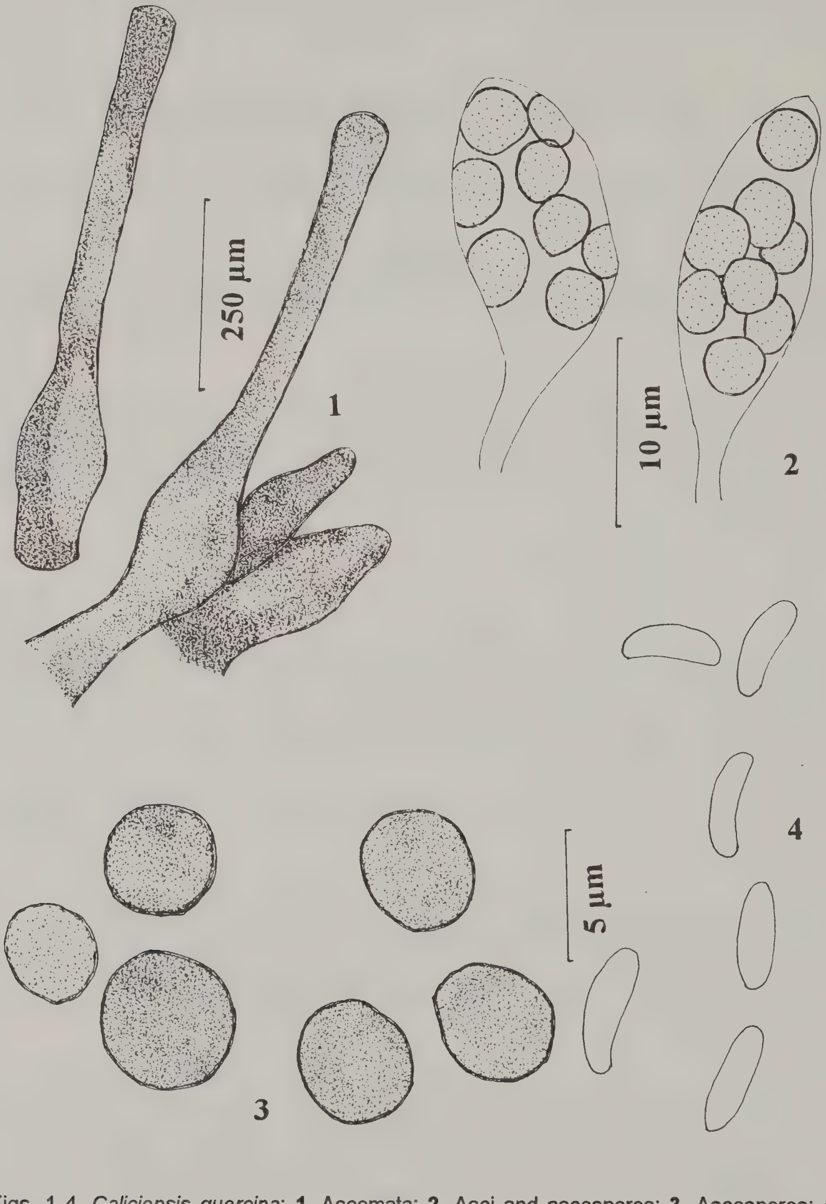
Fig. 1-4

Ascostromatibus aggregatis, atra, subcylindricis, 600-900 μm altis, 40-80 μm diam. Loculo fertili submediano, 125-195 x 80-140 μm. Pedicello cylindraceo, 90- 150 x 50-80 μm. Ascis clavatis, unitunicatis, octosporis, parte cum sporifera 14-18 x 6-9 μm. Ascosporis levibus, hialinis deinde brunneis, globosis vel subglobosis, 4-7 μm diam. Spermogoniis atris, subglobosis, 150-300 μm diam. Spermatiis hyalinis, allantoideis, 3-5 x 1-1.5 μm.

Holotypus: In tumorem Callirythidi associatum in ramis vivis *Quercus canbyi*, Iturbide, Nuevo León, México, Legit J.G. Marmolejo, 20 Feb. 1997; in herbario CFNL depositus. Isotypus in BPI.

Ascostromata gregarious, on galls on living twigs of *Quercus canbyi*, black, subcylindric, 600-900 μm high, 40-80 μm diam. Ascigerous locule submedian, 125-195 x 80-140 μm. Pedicel cylindrical, 90-150 x 50-80 μm. Asci clavate, thin-walled, eight-spored, evanescent, sporiferous part 14-18 x 6-9 μm. Ascospores smooth, at first hyaline later becoming brown, globose to subglobose, 4-7 μm diam. Spermogonia subglobose, black, 150-300 μm diam. Spermatia hyaline, allantoid, 3-5 x 1-1.5 μm.

Specimens examined: MEXICO: Nuevo León: Iturbide, Bosque Escuela, 1650 m.s.l., J.G. Marmolejo, 20 Feb. 1997, CFNL 1352 (holotype in CFNL, isotype in BPI); F. Caldera, 24 Feb. 1994, CFNL 1720; F. Caldera, 01 Mar. 1994; J.G. Marmolejo, 21 Mar. 1997, CFNL 1395; J.G. Marmolejo, 03 Apr. 1997, CFNL 1406; Galeana, Cerro del Potosí, 2200 m.s.l., J.G. Marmolejo, 29 Aug. 1992, CFNL 1221; Linares, Cañón de Jaures, La Florida, F. Caldera, 24 Jan. 1996.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Figs. 1-4, *Caliciopsis quercina*: **1**. Ascomata; **2**. Asci and ascospores; **3**. Ascospores: **4**. Spermatia. From holotype.

Distribution: Known only from Nuevo León, México. *Quercus canbyi*, main host of *C. quercina* is known, according with Nixon (1993), from Northeast Mexico (Coahuila, Nuevo León and Tamaulipas).

DISCUSSION

Fitzpatrick (1920, 1942) and Benny *et al.* (1985) cited *Caliciopsis subcorticalis* (Cooke & Ellis) Fitzp. growing on *Quercus*. This species differs from *C. quercina* in having its ascigerous locule subterminal, bigger ascocarps (up to 3 mm high) and smaller ascospores and spermatia (4-5 µm diam., and 2.5-3.5 long, respectively).

Hansford (1956) described *Caliciopsis elytranthicola* Hansford from Borneo. This species differs from *C. quercina* by its median ascigerous locule and its host range growing on flowers of *Elytranthe albida* (Blume) Blume, a tropical mistletoe from Southeast Asia.

Caliciopsis nigra (Schrad. ex Fr.) Fitzp. is another species that has been cited growing on galls by Arnaud (1930), Fitzpatrick (1942), Intini (1980) and Marmolejo (1996). This species is easily distinguished from *C. quercina* by its smaller ascocarps and its basal ascigerous locule.

In some galls (CFNL 1720) kept under controlled conditions of moisture and temperature to promote the development of gall insects, *Caliciopsis quercina* was able, in few cases, to proliferate after dehiscence. According with Benny *et al.* (1985) only *Caliciopsis maxima* (Berk & M.A. Curtis) Höhn. and *C. podocarpi* Huguenin have this ability. *Caliciopsis maxima* differs from *C. quercina* by its bigger ascocarps, smaller ascospores and host range. *Caliciopsis podocarpi* is easily distinguished from *C. quercina* by its ellipsoid ascospores.

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A NEW SPECIES OF MARSSONINA ON CELASTRUS ORBICULATUS

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ABSTRACT: A species of *Marssonina* associated with leaf spots on *Celastrus orbiculatus* is studied. It seems that this fungus has previously been referred to *Septogloeum thomasianum*, but on account of its holoblastic conidiogenesis and transversely one-septate conidia, it belongs to the genus *Marssonina* and is described and illustrated as *Marssonina celastri* sp. nov.

Keywords: *Marssonina*, *Celastrus*, new species.

Although not cultivated, the oriental bittersweet, *Celastrus orbiculatus* Thunb., is important as a source for flower arrangement art due to its beautiful fruits. We found that a leaf spot disease was common on young leaves of small plants growing in the shade, but less common on mature leaves under natural conditions. The fungus associated with the leaf spot initially formed small blackish brown lesions on young leaves, followed by severe premature defoliation of the tree.

The first collection was made in late autumn of 1994. Having acervular conidiomata and uniseptate conidia with unequal cells, the causal agent was tentatively classified as *Marssonina* sp. Five additional collections were proved to be associated with the same fungus and deposited at Herb. SMK (Dept. of Agricultural Biology, Korea University, Seoul, Korea) as SMK 14150 (14 IX 1997, Yangku), 14675 (22 VI 1997, Seoul), 14972 (29 VIII 1998, Seoul), 15024 (4 IX 1998, Seoul), and 15093 (11 IX 1998, Seoul).

By its foliicolous nature, its acervular conidioma (Fig. 1-c), holoblastic conidiogenesis (Fig. 1-b), and hyaline, transversely one-septate conidia with unequally large cells (Fig. 1-a), this fungus agrees well with the generic

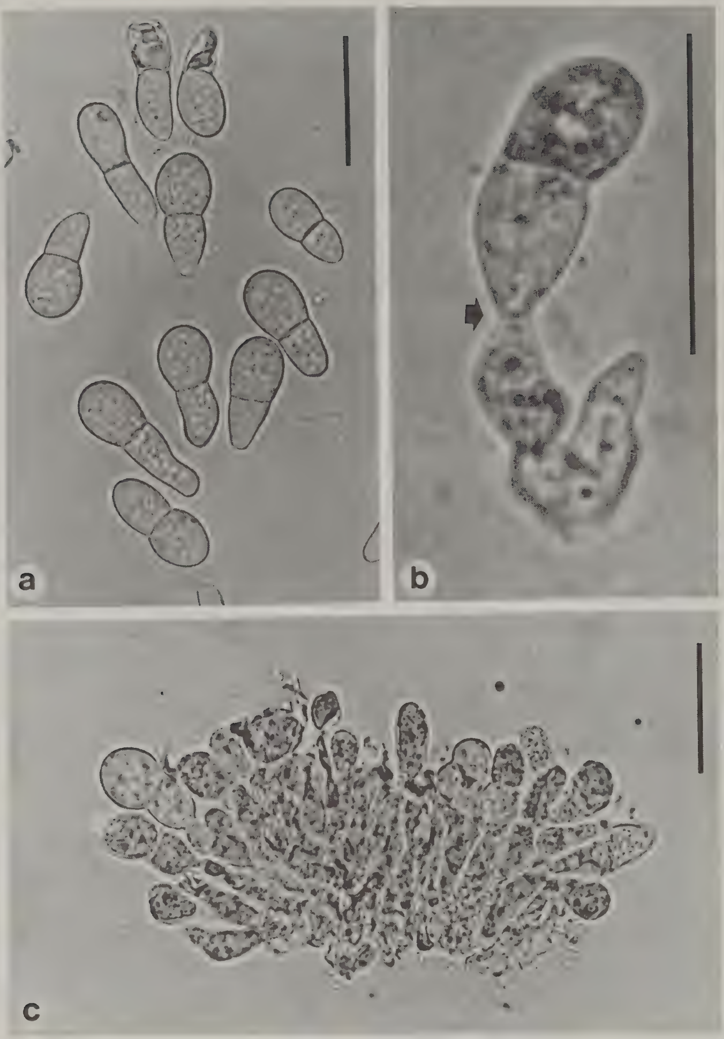

Fig. 1. *Marssonina celastri* H.D. Shin & H.T. Lee. (a) Conidia. (b) Immature conidium on a biforked conidiogenous cell. Note the holoblastic conidiogenesis (arrow). (c) Part of an acervulus. Scale bars = 30 ㎛.

concept of *Marssonina* as defined by Sutton (1980) and emended by Farr (1993). It is characterized by large acervuli and comparatively broad conidia. *M. capsulicola* (Rostr.) Magnus has also very large conidiomata [640~1360 ㎛, unpublished data from the senior author; 1 mm according to Saccardo

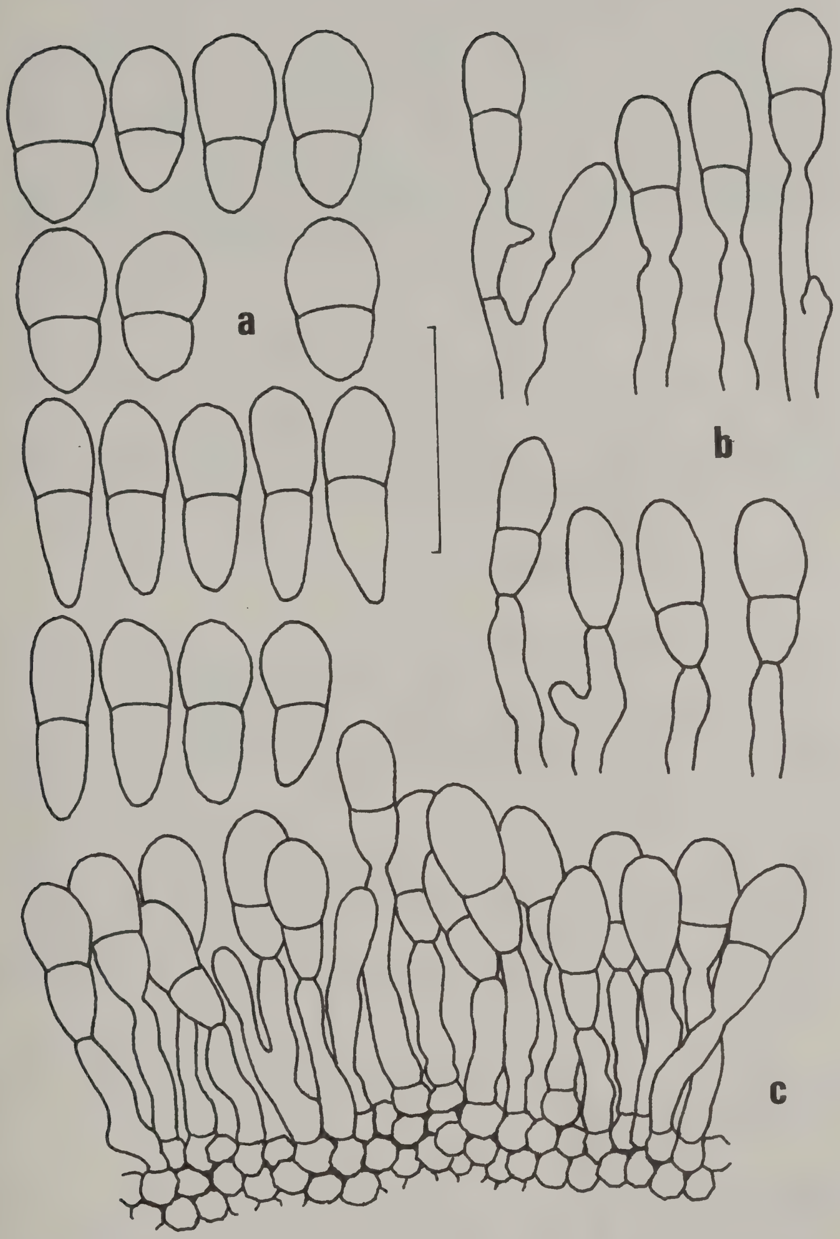

Fig. 2. *Marssonina celastri* H.D. Shin & H.T. Lee. (a) Conidia. (b) Immature conidia on conidiogenous cells. (c) Part of the acervulus. Scale bar = 30 μm.

(1902: 1011)], but differs from the present species in conidia rounded at both ends and the occurrence on *Euonymus* spp.

Literatures review revealed that *Marssonina thomasiana* (Sacc.) Sacc. [now *Septogloeum thomasianum* (Sacc.) Höhn., according to Farr (1993)] has been recorded on *Celastrus* spp. from the USA (Boothroyd, 1951; Jenkins & Jehle, 1951; Greene, 1958). North American collections have not been examined, but they are very probably conspecific with the Korean specimens described in this paper. *M. thomasiana* was originally described as associated with *Euonymus* spp. and later transferred to the genus *Septogloeum* based on the enteroblastic conidiogenesis in this species (Farr, 1993). It seems that the conidiogenesis in collections on *Celastrus* spp. has never been studied in detail. Although conidia of the present species are similar to 1-septate conidia of *S. thomasianum* in size and gross morphology, our collections show neither non-septate nor two- and three-septate conidia. Furthermore, *Marssonina* is described as having holoblastic, annellidic conidiogenous cells, while *Septogloeum* is known as having enteroblastic, phialidic conidiogenous cells (Sutton, 1980; Farr, 1993). Therefore, our fungus is a member of *Marssonina* and has to be treated as a new species.

Marssonina celastri H.D. Shin & H.T. Lee (Figs. 1 & 2)

Maculae amphigenae, discretae vel confluentes, 1~3 mm diam., circulares vel subcirculares, dissitae; maculae epiphyllae area centralis initio atro-brunnea cum margine angustata, purpurea, dein brunneola vel albida cum margine plus minusve atro-brunnea. Conidiomata acervulata, amphigena, dissita, circularia vel subcircularia, subcuticulata, erumpentia, brunnea, ca. 200~800 ㎛ diam.; stroma basale ca. 20~40 ㎛ crassa, ex 3~6 stratis cellulis compositum. Conidiophora nulla. Cellulae conidiogenae hyalinae, determinatae, cylindricae vel obpyriformae, interdum irregulares, 16~36 × 4.2~6.8 ㎛, interdum ad basim bifurcatae. Conidia holoblastica, hyalina, raro subhyalina, eguttulata, recta vel leviter curvata, inaequaliter bicellulares, cellula superna magnior, apicem rotundata, basim late acuta, ad septa leniter constricta, 22~33 × 8.2~14.4 ㎛.

Holotypus: On living leaves of *Celastrus orbiculatus* Thunb. (Celastraceae), Kangnung, Korea, 8 XI 1994, H.D. Shin (SMK 13360)
Isotypus: HAL

Leaf spots amphigenous, descrete to confluent; discrete lesions 1~3 mm diam., circular to subcircular, scattered; epigenous lesions initially with a dark brown, central area surrounded by a narrow purple halo, older lesions with a central pale brown to white area surrounded by a more or less dark brown margin; hypogenous lesions similar to epigenous ones but without distinct coloration. Conidiomata acervular, amphigenous, discrete, circular to subcircular, erumpent through the cuticle, brown, ca. 200~800 ㎛ diam., composed of 3~6 layers of cells, basal stroma ca. 20~40 ㎛ deep, dehiscent by irregular rupture of the host cuticle. Conidiophores absent. Conidiogenous cells hyaline, determinate, cylindrical to obpyriform or irregular, 16~36 × 4.2~6.8 ㎛, sometimes biforked at the base. Conidia holoblastic, hyaline, rarely subhyaline, eguttulate, straight to slightly curved, unequally two-celled, upper cells larger, lower cells smaller, apex broadly rounded, base rounded to attenuated-subacute, mildly constricted at the septa, 22~33 × 8.2~14.4 ㎛.

ACKNOWLEDGEMENTS

We are very grateful to Dr. Uwe Braun, Martin-Luther-Universität, Germany, for his kind comments on the species and for acting as a presubmission reviewer, and to Dr. Ovidiu Constantinescu, Uppsala University, Sweden, for checking the Latin description.

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MYCOTAXON

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PHLEBOPUS BRUCHII (BOLETALES): AN EDIBLE FUNGUS FROM ARGENTINA WITH POSSIBLE COMMERCIAL VALUE

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ABSTRACT

Phlebopus bruchii (Boletales) is an edible fungus from Argentina which has morphological and culinary features that make it interesting as a possible commercial item. A full description as well as ecological data are presented. The taxonomical status of the species is discussed.

Key words: *Phlebopus bruchii*, Agaricales, chorology, taxonomy, Argentina, America.

INTRODUCTION

At present, interest in edible fungi as a natural food-source is increasing on the American continent. In this regard, Guzman & al. (1993) compiled data on the cultivation of edible fungi in Mexico, and, more recently, PALM & CHAPELA (1997) published on the commercialization of fleshy fungi.

Phlebopus bruchii is a medium sized member of the Boletales growing under *Fagara coco* (Rutaceae), which frequently occurs in open subxerophytic regions in central Argentina. This tree also grows in Bolivia, but we do not have records about the fungus from there.

The mountain zone of the province of Córdoba is climatically defined by its semiaridity, water shortage, and precipitations concentrated during summer (December, January and February). In these mountains P. *bruchii* was found at an altitude varying from 550 m (Alta Gracia) to 1200 m (Los Cocos). The annual precipitation ranges from 535 to 700 mm, and is about 300 mm during the hot months of the fruiting period. The annual average temperature is approximately 16°C, the average during the summer months 19-23°C.

The material studied is preserved in the Departamento of Biologia Vegetal of the University of Alcalá de Henares (AH), and a duplicate in the mycological herbarium of the Departamento de Ciencias Biológicas, University of Buenos Aires (BAFC). Annotations of colors (in brackets) refer to Munsell (1994).

***Phlebopus bruchii* (Speg.) Heinem. & Rammeloo, *Mycotaxon* 15: 391 (1982)** **Figs. 1-10**

≡ *Boletus bruchii* Speg., *Bol. Acad. Nat. Cienc. Córdoba* 28: 351 (1926)

= *Phaeogyroporus braunii* (Bres.) Singer, *sensu* Singer, *Lilloa* 22: 646 (1949)

= *Phaeogyroporus tropicus* (Rick) Singer *f. microsporus* Singer, *Lilloa* 23: 234 (1950)

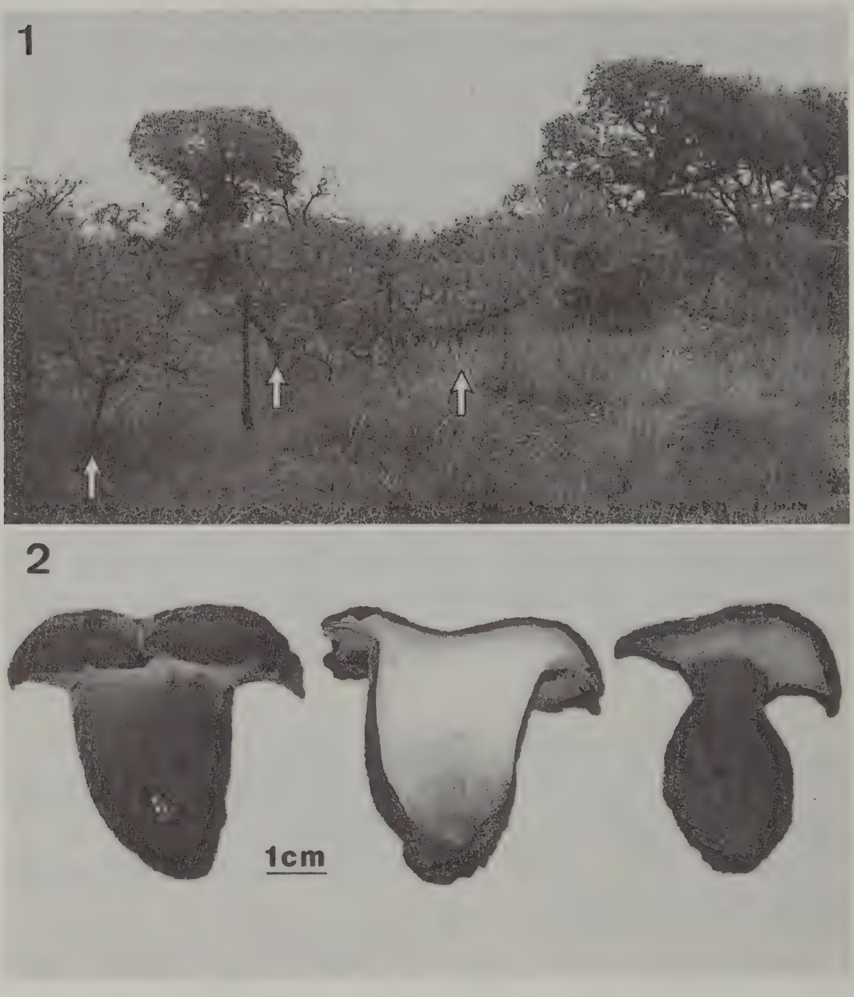
Pileus 4-7.5 cm in diam., convex to slightly depressed in the center, dark brown (7.5YR 3/2) to blackish brown at maturity resembling *Boletus aereus*, velvety, margin slightly decurved to rectum. **Tubes** adnate to slightly decurrent, yellow with olive tinges (10YR 7/6); narrow, up to 4 mm long, concolorous with pores. **Pores** homogeneous and isodiametric, 4-5 per mm. **Stipe** 6-7.5 x 3-4.5 mm, variable, solid, slightly attenuate towards the base. **Flesh** whitish, slightly yellowish under the pileipellis, somewhat darker towards the base of stipe, turning deeply blue in its lower half. Stem base with a dark brownish grey (10YR 2/2) cortex. **Taste** slightly earthy.

Spores 6-7 x 5-6 µm, subglobose to broadly ellipsoid, smooth, apex obtuse, yellowish to greyish brown when mature, smooth under SEM. **Basidia** 28-32 x 10-12 µm, clavate, 4-spored, clamped. **Cystidia** not observed. **Pileipellis** 3-layered with cylindric, more or less recurved cells with blunt ends, thin-walled, and with an internal, uniform light brownish pigment. Terminal cells cylindric, 40-72 x 4-7 µm. Clamps abundant in hymenophore and pileipellis.

Culture characteristics: aerial mycelium mat yellowish brown (2.5Y 5/4 to 5/5), in the substrate 5YR 4/2 y 4/3. Microscopically, the hyphae are 3-5(-7) µm broad, hyaline, cylindrical, branched, septate, and clamped. Terminal cells obtuse.

Material studied: Argentina. Villa General Belgrano, Córdoba, on ground associated with *Fagara coco* (Gill.) Engler (Rutaceae) called "coco" or "cochucho", 15-1-1997, *leg.* J. Deschamps. BAFC 34430 duplicate in AH 19530. Culture on BAFC 96 in AH 19569.

Remarks: Our material is characterized by its dark brownish grey basidiomes, narrow tubes with isodiametric pores, whitish to yellowish white flesh which turns intensely blue in the lower half of the stipe, 3-layered pileipellis, subglobose to broadly ellipsoid, smooth spores, and the presence of clamp connections. It is commonly found growing under *Fagara coco.*



Figs. 1-2: 1. Subxerophytic habitat of *Fagara coco* (Rutaceae). Is (are) indicated by arrows. 2. Basidiomes of *Phlebopus bruchii* AH 19530.

Figs. 3-11: *Phlebopus bruchii* AH 19530 - 3. Terminal cell of pileipellis hypha. 4. Septum with clamp connection. 5. Basidiole. 6-7. Basidia. 8-9. Basidiospores. 10-11. SEM micrographs of basidiospores.

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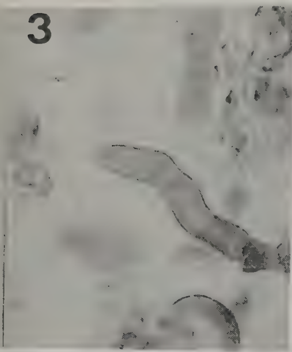

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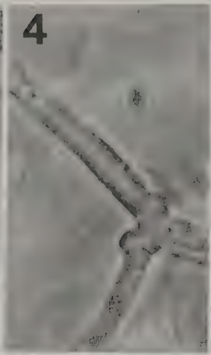

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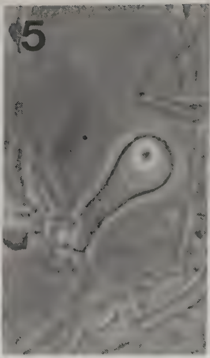

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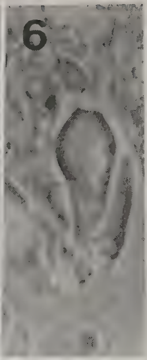

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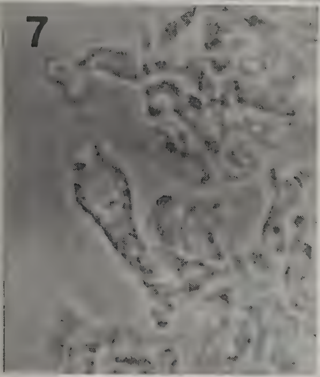

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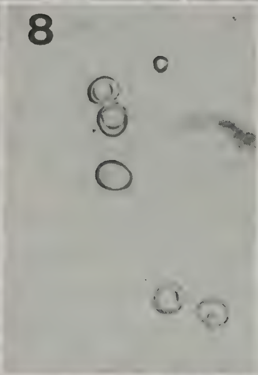

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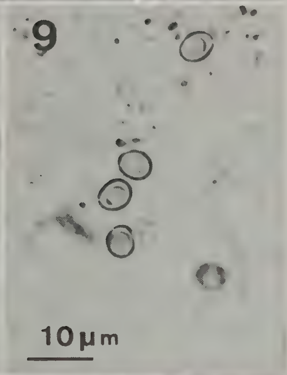

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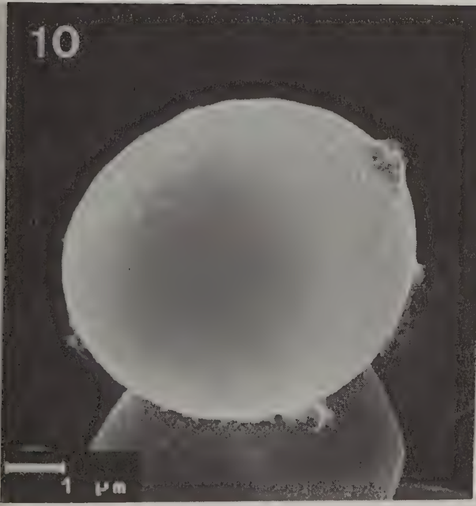

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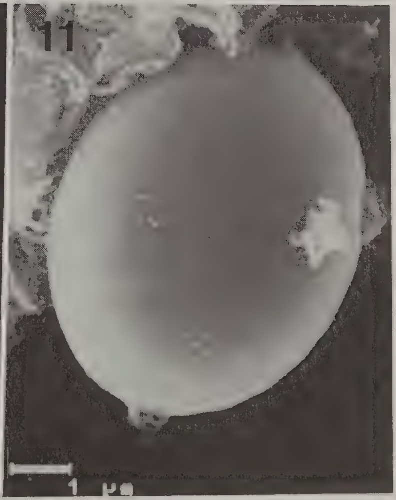

The original description of SPEGAZZINI (1926) corresponds very well to our observations. The fungus is frequently found in Alta Gracia under environmental conditions as mentioned above. The specimens of our collections showed a somewhat darker, nearly blackish pigmentation (cap and stipe), a difference that we have not considered as significant, since such variations often depend on climatic conditions.

This species is locally very abundant in the mountain areas of Córdoba and San Luis during January and February beeing always associated with the "coco" tree.

Referring to the taxonomical status of the species we follow HEINEMANN & RAMMELOO (1982) who revised the genus *Phlebopus* placing Spegazzini's species in this genus while the genus *Phaeogyroporus* Singer is considered synonymous.

Phlebopus bruchii, as indicated by both SPEGAZZINI (1926) and HEINEMANN & RAMMELOO (1986), is similar to *Phlebopus tropicus* (Rick) Heinem. & Rammeloo, originally described by RICK *in* REHM & RICK (1906). The latter was collected in Río Grande Do Sul, Brazil, in a subtropical rain forest. This distinctly subtropical species grows under different climatical conditions (e.g. annual precipitations up to 2000 mm, annual average temperature 23°C); its pores are larger, elongated, and irregularly shaped. Additional distinctive characters of *P. bruchii* are its bluing flesh and the presence of clamp connections in all tissues.

SINGER (1949) synonymized Spegazzini's species with *Phaeogyroporus braunii* which represents a critical species according to HEINEMANN & RAMMELOO (1986). Later, SINGER (1950, 1957) considered *Boletus bruchii* Speg. as a synonym of *Phaeogyroporus tropicus* (Rick) Singer designating it as *forma microsporus* (*forma macrosporus* = *Boletus tropicus* Rick). For the reasons mentioned above, we prefer to maintain *P. tropicus* and *P. bruchii* as autonomous species. For a more

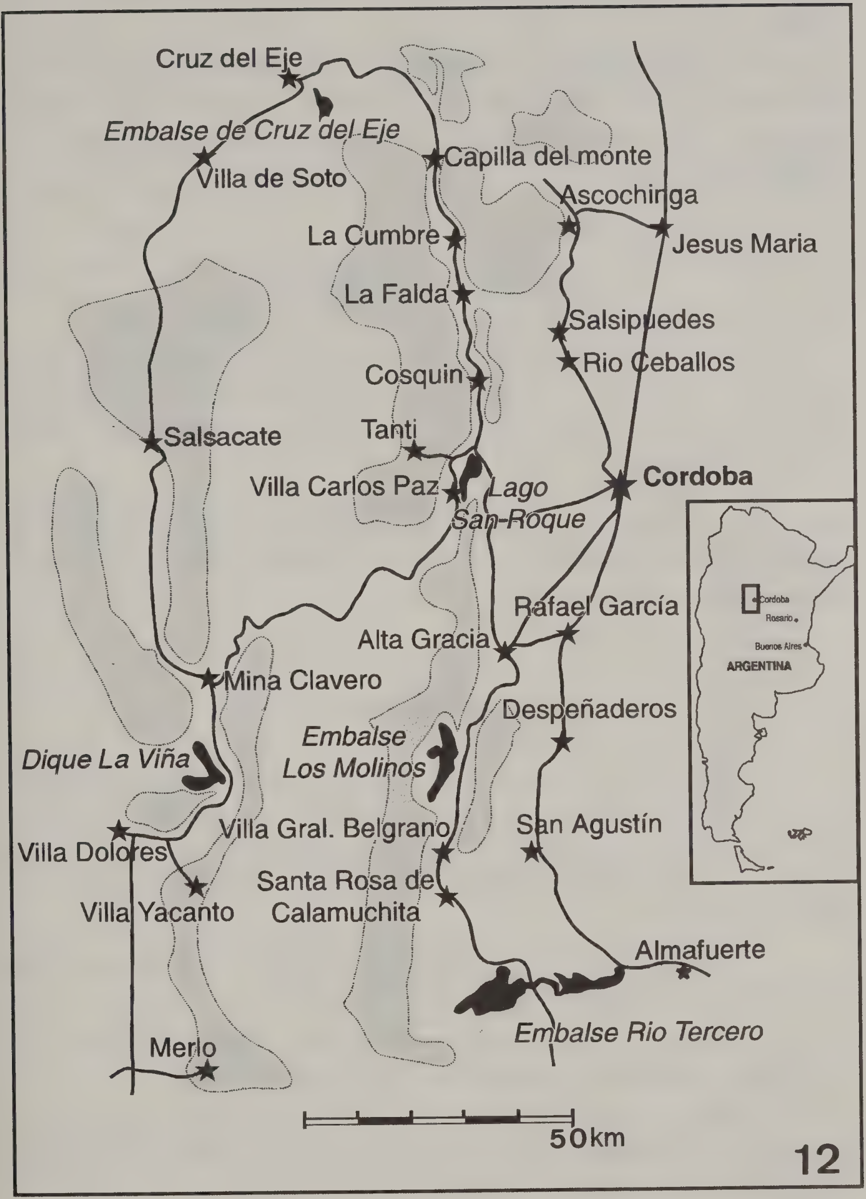
Cruz del Eje
Embalse de Cruz del Eje
Villa de Soto
Capilla del monte
Ascochinga
Jesus Maria
La Cumbre
La Falda
Salsipuedes
Rio Ceballos
Cosquin
Tanti
Salsacate
Cordoba
Villa Carlos Paz
Lago
San Roque
Rafael García
Alta Gracia
Mina Clavero
Despeñaderos
Embalse
Los Molinos
Dique La Viña
Villa Gral. Belgrano
San Agustín
Villa Dolores
Santa Rosa de
Calamuchita
Villa Yacanto
Almafuerte
Embalse Rio Tercero
Merlo
50km
Cordoba
Rosario
Buenos Aires
ARGENTINA
12

Fig. 12: Distribution of *Fagara coco* (Rutaceae) in the mountainous areas of Córdoba and San Luis (Argentina), where *Phlebopus bruchii* fructifies in January and February.

critical re-evaluation, new records of *P. tropicus* would be helpful.

The edibility of *Phlebopus bruchii* was indicated for the first time by SPEGAZZINI (1926 b); it is, however, a rather common mushroom, traditionally collected and appreciated by indigenous people.

ACKNOWLEDGMENTS

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TYPE STUDIES IN THE POLYPORACEAE 26 SPECIES DESCRIBED BY A.M.F. PALISOT DE BEAUVOIS

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Abstract. The 6 polypores described by P. Beauvois have been revised and 4 are accepted and two are reduced to synonymy. The combination *Hexagonia glaber* (P. Beauv.) Ryvarden is proposed.

Kew words. Beauvois, polypores.

Introduction.

Palisot de Beauvois is mainly known for his famous work "Flore d Oware et de Benin en Afrique" published in fascicles between 1806 and 1820. The work includes mainly higher plants, beautifully illustrated by large colour plates. However, he included also a number of fungi, mostly polypores, presumably because they are easy to conserve in contrast to the more ephemeral agarics.

Fries (1821) included of unknown reasons only a number of Beauvois´ fungi and their names are thus sanctioned by article 15 in the International Code of Botanical Nomenclature. Until 1981 when the cited rule was introduced by the Sydney Botanical Congress, all names published before 1821 were invalidly published including those of Beauvois except for those accepted by Fries in Systema mycologicum. However, today also Beauvois´ other names are valid and legitimate and must be taken into consideration both when it comes to priority and to avoid homonyms in the future. Thus, it seemed desirable to give a complete account of all the 6 polypores published by Beauvois.

The dates of publication for the different fascicles are taken from Stafleu & Cowan (1976). No type-specimens are known for the Beauvois´ species, but the colour drawings are very elegant and in all cases there is no doubt of their identity. The type locality is in all cases Nigeria, and this is not repeated for each species.

The species are listed alphabetically according to specific epithet. The loose fascicles were finally bound in two volumes and the place of publication refers of convenience to these volumes as 1 or 2 and the page on which the species were described and the original year of publication.

amanitoides, Daedalea 1:44, 1805.
= *Trametes elegans* (Spreng.:Fr.) Fr.
concinnus, Microporus 1:73, 1806.
This is an accepted species in *Microporus*, for a description, see Ryvarden & Johansen 1980:435.
glaber, Favolus 2:76, 1819.
= *Hexagonia glaber* (P. Beauv.) Ryvarden comb. nov. Basionym: *Favolus glaber* P. Beauv., Flora d´Oware et de Benin Vol 2:76, 1819. This is a prior name for *Boletus tenuis* Hooker 1822, better known as *Hexagonia tenuis* (Hooker) Fr., a widespread, but not common species. The Beauvois specific epithet is actually better since the species always has a completely glabrous pileus, while the size and thickness vary considerably (tenuis = thin).
hirtus, Favolus 1:1, 1805.
= *Hexagonia hirta* P. Beauv.: Fr. For a description see Ryvarden & Johansen 1980: 371.
perula, Microporus 1:14, 1805.
= *Microporus xanthopus* (Fr.) Kunth.
tenuiculus, Favolus 1:74, 1806.
= *Polyporus tenuiculus* (P. Beauv.) Fr. 1821:344.
This is a widespread pantropical taxon and repeatedly described as new from different parts of the world. Fries himself was a part of this tradition as he described it again as *Daedalea brasilensis* Fr. 1821:322, being unaware of the synonymy with Beauvois´ species, which he accepted 22 pages later in the same book.

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MYCOSOCIOLOGY IN NATIVE FORESTS OF NOTHOFAGUS OF THE X REGIÓN OF CHILE, DIVERSITY AND ECOLOGICAL ROLE

by

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Summary: A mycosociological and taxonomical comparative study of the *Agaricales s.l.* fruifing in *Nothofagus* forests from the Cordillera de la Costa, Depresión Intermedia and the Cordillera de los Andes, X Región, Chile, was carried out. In the forests of *Nothofagus* the percentage of mycorrhizal species varies between 40.4% to 52.2% and the saprophytic between 47.8% to 69.4%. A large number of species belonging to *Cortinarius* were detected. In all the studied native forests, we found the following mycorrhizal species: ***Amanita diemii***, ***Cortinarius magellanicus***, ***Russula fuegiana*** and ***Tricholoma fusipes***, all associated to different *Nothofagus* species. The species of the genus *Boletus* and *Stephanopus* associated to ***Nothofagus dombeyi***, ***N. obliqua*** and ***N. alpina*** were only found in the native forests of the Cordillera de la Costa, while ***Amanita aurantiovelata*** and ***Russula nothofaginea*** associated to ***N. dombeyi*** and ***N. obliqua*** were found exclusively in the forests located in the Depresión Intermedia. In *Nothofagus* forests of the Cordillera de los Andes we did not found any characteristic mycorrhizal *Agaricales*. No species of *Lactarius* were recorded in native forests, but in those with some kind of anthropic disturbance or located near ***Pinus radiata*** plantations, we found the mycorrhizal species ***Amanita rubescens***, ***Amanita muscaria***, ***Xerocomus rubellus***, associated with ***N. obliqua***, and ***Paxillus involutus***, associated to ***Luma apiculata***. The species of the genus *Mycena* dominate among the saprophytic *Agaricales* in all the *Nothofagus* forests.

Key words: *Agaricales s.l.*, taxonomy, mycosociology, *Nothofagus* spp., Chile.

INTRODUCTION

Most of the mycosociological studies describing the interrelations among the *Agaricales s.l.* and the South American *Nothofagus* species usually address their interest on andinopatagonical forests in Argentina (Singer & Morello 1960; Singer 1971; Wright 1988; Godeas et al. 1993a, b, c).

The *Nothofagus* forests of the X Región of Chile, the area involved in the present study, were investigated by Singer & Moser (1965), who contributed with the sole mycosociological information, up to date, regarding the relations between *Agaricales* and *Nothofagus*. More specifically they focused on the arboreal communities present in the Cordillera Pelada (section of the Cordillera de la Costa), showing that these forests are ectotrophic.

According to Ramírez & Figueroa (1987) in the X Región of Chile seven plant formations, dominated by *Nothofagus* are present, some of which are being replaced by ***Pinus radiata*** plantations. The increasing development of forestry in Chile makes if necessary to improve our knowledge on the fungal communities present in these forests, especially because of the important role of the latter as saprotrophs, symbionts and parasites in these ecosystems. Moreover, the state of conservation of a forest is highly depending on the fungal communities present in the latter. The data obtained from the mycosociological studies allow to establish some guidelines for the correct forest management and exploitation, as well as to choose correctly which fungi may be used as symbionts in the reforestation. In addition, these studies provide data on the fungal biodiversity of these forests enabling us to detect possible alterations and interactions with the introduced exotic plants.

In this contribution, the results of a mycosociological and taxonomic study carried out during five years are presented. The *Agaricales s. l.* fruiting in *Nothofagus* forests of the Cordillera de la Costa, Depresión Intermedia and Cordillera de los Andes of the X Región of Chile, are compared, especially those aspects concerning their diversity and ecological role.

MATERIAL AND METHODS

To enable the collection of a large number of fruitbodies of the *Agaricales s.l.* from the *Nothofagus* forests located in the Cordillera de la Costa, Depresión Intermedia and Cordillera de los Andes of the X region of Chile, a five year sampling from april to june was carried out. The following is a brief characterization of each area:
1. Cordillera de la Costa. Three sub-areas are included:
- 1.1. Cordillera Pelada: located on clay-red soil, Valdivia (40 21´S, 72 57´O). Under Cordillera Pelada's name six sampling localities were considered: Estación La Unión, Roblental, Refugio Mirador, Alerce, Chivería and Cordillera Pelada grouping, in which we can find native species such as ***Nothofagus alpina***, ***N. antarctica***, ***N. dombeyi***, ***N. nitida***, ***Aextoxicon punctatum***, ***Laureliopsis philippiana***, ***Weinmannia trichosperma***, ***Amomyrtus luma***, ***Fitzroya cupressoides*** and ***Eucryphia cordifolia*** (Ramírez et al. 1996).
- 1.2. Popoén, San Juan de la Costa: located in the precordillera de la Costa, on clay-red soil, Osorno (40 43´S, 73 29´O). Here we can find ***Nothofagus dombeyi*** and ***N. obliqua*** degraded forests, surrounded by ***Pinus radiata*** plantations.

2. Depresión Intermedia. The sub-areas included were:
- 2.1. Rebellín: located on clay-red and some sectors with trumaos soils, Valdivia, (39 44´S, 73 11´O). The forest is mainly represented by ***Nothofagus alpina***, ***N. dombeyi***, ***N. obliqua*** in which, due to the proximity to the rivers that cross it, we can found a hualve (Ramírez et al. 1996), where several arboreal species are present, such as ***Blepharocalyx cruckshanksii***, ***Drimys winteri***, ***Luma apiculata***, ***L. gayana*** and ***Myrceugenia exsucca***. Surrounding the forest here is a grassland composed by ***Agrostis capillaris*** - ***Acaena ovaliforia*** (Ramírez et al. 1993).

2.2 Los Troncos: located on trumao soil, Valdivia, (40 00´S, 73 58´O), It is a deteriorated forest, however, some specimens of ***Nothofagus dombeyi***, ***N. obliqua*** and ***Chusquea quila*** can be observed.

3. Cordillera de los Andes. The sub-area included was:
- 3.1. Antillanca: located on trumao and ñadi soils, Osorno, (40 45´S, 72 08´O). Under the name of Antillanca five sampling localities have been considered: Cruce Pichi Damas; Cruce Rucatayo; Aguas calientes; Puyehue and Antillanca. In all of them a group of native threes can be observed, begining, in the precordillera, at the level of the ñadis (Cruce Pichi Damas). Species like ***N. antarctica***, ***Chusquea uliginosa***, ***Chusquea culeu*** are present, while ascending in altitude ***N. obliqua-Laurelia serpervirens-Persea lingue***, ***Myrceugenia exsucca***, ***Aextoxicon punctatum***, ***N. dombeyi-Eucryphia cordifolia***, ***Luma apiculata***, ***Laureliopsis philippiana-Weinmannia trichosperma***, ***N. nitida*** and ***N. pumilio*** are found (Ojeda et al. 1991).

The substratum or the arboreal species in which *Agaricales s.l* were collected, are indicated with a number in brackets assigned according to each forest. The ecological role of the *Agaricales s.l.* is referred to using the terminology of Wright (1988) and Moreno & Illana (1992). The fungal species are ordered mentioning their relation with the substratum on which they fruit using the following abbreviations: humicolous (Sh); foliicolous (Sf); lignicolous (Sl); living on dead stumps and/or trunks (Sltm); ocurring on living stumps and/or trunks(Sltv); ramicolous (Sr) ocurring on living branches (srv) or insolent (Srm); coprophilous (Sc); species living in prairies (Spr); sphagnicolous (Ss); parasitic (P) and mycorrhizal (M).

The macro and microscopic characterization of the basidiocarps were carried out according to Moreno et al. (1986). The material has been deposited in AH (Herbarium of the University Alcalá de Henares, Madrid, Spain) and a duplo is kept in the particular Herbarium of the first author.

RESULTS AND DISCUSSION

The mycorrhizal and saprophytic *Agaricales s.l.* collected in the Cordillera de la Costa *Nothofagus* forests, are tabulated in Table 1. In the Cordillera Pelada and Popoén forests, 16 (45,7%) and 14 (51,8%) mycorrhizal species were collected respectively., which belong to 9 genera. The genus *Cortinarius* is present in the Cordillera Pelada forest with a large number of species, all of them associated with ***Nothofagus dombeyi*** and ***N. obliqua***, as discussed previously by Singer (1965). In the forest of Popoén the predominating taxa were species of *Tricholoma* associated with ***N. obliqua***. This could be due to the fact that in this forest some pasture and anthropic management is done. In addition, there is a ***P. radiata*** plantation, allowing the growth of ***Amanita rubescens*** specimens now associated to *Nothofagus*. ***A. rubescens*** is an ectomycorrhizal species that was introduced with ***P. radiata*** in Chile (Garrido & Bresinsky, 1985). Besides, we could also detect the presence of ***A. muscaria*** and ***Paxillus involutus***. We believe they present the capacity to displace some native mycorrhizal *Agaricales*, such as the species of the genus *Cortinarius*.

In both forests of the Cordillera de la Costa several species of the genus *Boletus* were collected (see Table 1), which agrees is with Horak´s (1977) and Valenzuela´s *et al.* (1992) observations. Moreover, in the Cordillera Pelada forest the genus *Stephanopus* was detected. Apparently these two genera are limited geographically by climatic conditions to the Cordillera de la Costa (Garrido, 1988; Valenzuela *et al.* 1992) and, besides, *Stephanopus* is endemic and typical of the *Nothofagus* forests of South America (Moser & Horak, 1975).

In Cordillera Pelada Nothofagus forests (Table 1) a large and diverse number of saprophytic *Agaricales*, i.e. 19 (54,2%), dominated by the genus *Mycena*, were detected. This agrees with the results of Garrido

(1985, 1988) and Valenzuela & Moreno (1995). The species of *Mycena*, according to Smith (1947), Horak (1980) and Maas Geesteranus (1992a, b), are saprophytic and not mycorrhizal as indicated by Donoso (1989). Their growth is favored by their small and not very fleshy fruit bodies; besides, their preferably muscicolous development protects them from the direct rain, which is responsible for the quick descomposition of the mediun to large fleshy basidiocarps of other *Agaricales*. Among the Mycenas collected two are outstanding: viz. ***Mycena chusqueophila*** and ***M. galericulata***. The former is one of the few species able to colonize the vegetable remainders of ***Chusquea quila*** as well as living or dead trunks of native and exotic arboreal species (Maas Geesteranus, 1992a, b). In addition, in these forests the presence of *Armillaria*, *Hypholoma*, *Pholiota*, *Pluteus* and *Psathyrella* fruiting on trunks and stumps is also important. Garnica (1995) reported the isolation of their corresponding mycelial strains in pure culture, detecting a marked lignocellulolytic ability. The same or a slighly higher percentage of saprophytic *Agaricales* in relation to the mycorrhizal species (Table 1), represents for this forests a good level of degradation of the vegetable remains, which points to an acceptable humus production and recirculation of chemical elements for the biogenic cycles.

The mycorrhizal and saprophytic *Agaricales s. l.* collected in the Depresión Intermedia *Nothofagus* forests, are tabulated in Table 2. In Rebellín and Los Troncos forests, 25 (52,1%) and 12 (52,2%) mycorrhizal species were collected respectively (Table 2), which belong to 8 genera. A large and diverse number of species belonging to *Cortinarius* were detected in Rebellín forest, all associated with ***Nothofagus dombeyi*** and ***N. obliqua***. In the Troncos forest, this genus shows the same ectomycorrizal relations though the diversity of species is lower, presumably because of the deterioration caused by the forest management. As we can see in Table 2, the number of mycorrhizal species in comparison to Rebellín forest is approximately the half. On the other hand, Los Troncos forest is close to plantations of ***P. radiata***, which are responsible for the introduction of exotic fungi, such as ***Xerocomus rubellus*** able to displace same native mycorrhizal species. In the Rebellín forest two typical taxa of the *Nothofagus* forests, located in the Depresión Intermedia of the X Región, were collected, viz. ***Amanita aurantiovelata*** and ***Russula nothofaginea***. The former is only known from the X Región of Chile (Schalkwijk & Jensen, 1982), whereas the latter shows a mucher wider distribution. More specifically ***R. nothofaginea*** has been recorded between Temuco and Magellanes (Garrido, 1988) and also from Argentina and Tierra del Fuego (Horak, 1980).

The percentage of saprophytic *Agaricales* in the Depresión Intermedia forests was slightly lower than that of the Cordillera de la Costa forests (see Table 2), but similar in number and diversity of representative *Mycena* species. Again in the Rebellín forest, the presence of *Armillaria*, *Hypholoma*, *Pholiota* and *Psathyrella* was stated, the significance of which was already discussed. In the Rebellín and Los Troncos forests, ***Gymnopilus chilensis*** was collected, apparently substitutes the *Pluteus* species in the degradation of vegetable remains. Close to the rivers and in the hualve of the Rebellín forest, species of the genus *Hygrocybe* were detected, in association with ***Luma apiculata***, ***L. gayana***, and ***Myrceugenia pitra*** woody remains (see Table 2). This observation agrees with Horak´s (1980), Singer´s (1969) and Garrido´s (1985) results. On this basis we can conclude that the species of the genus *Hygrocybe* thrive preferably on marshy soil and humid sites. On the other hand, in the prairies surrounding the Rebellín forest we collected ***Coprinus lagopus***, ***Gerronema minutum***, ***Lepista nuda***, ***L. sordida***, ***Macrolepiota mastoidea*** and ***Rickenella fibula***, all of them characteristic species in these plant communities. Besides, we also collected ***Panaeolus campanulatus***, ***P. retirugis*** and ***Stropharia semiglobata*** whose coprophilous nature points to the pasture management of these prairies.

The mycorrhizal and saprophytic *Agaricales s.l.* collected in the *Nothofagus* forests of the Cordillera de los Andes, Antillanca are tabulated in Table 3. A total of 21 (40,4%) mycorrhizal species were collected, which belong to 7 genera. As was discussed before for the Cordillera de la Costa and Depresion Intermedia forests the host representative species belong to the genus *Cortinarius*. The large number of saprophytic species collected (see Table 3), is due to the great quantity of vegetable remains (branches, leaves and trunks) laying on the soil, as a consequence of the detachment from the trees by the wind or the weight of the snow or avalanches in the hillsides. Among the saprophytic species the majority belong to the genus *Mycena*. Nevertheless, species of *Gymnopilus*, *Hypholoma*, *Pholiota*, *Pluteus* and *Psathyrella* were also detected.

According to Table 1, 2 and 3 in all Nothofagus forests studied the mycorrhizal species belonging to genus *Cortinarius* were the dominant taxa. This agrees with Moser & Horak´s (1975), Singer´s (1986) and Garrido´s (1988) results. In addition, ***Amanita diemii***, ***Cortinarius magellanicus***, ***Russula fuegiana*** and ***Tricholoma fusipes*** were common in all the native forests. The same species have been stated by Garrido (1988) as common in *Nothofagus* forests between the VII and VIII Región of Chile. Horak (1980) in his descriptions for these taxa indicated that they were broadly distributed in andinopatagonian argentinian forests. Maybe these species constitute the mycorrhizal base for *Nothofagus* forests of the Southern Hemisphere. In the *Nothofagus* forests of the Cordillera de la Costa, the genera *Boletus* and *Stephanopus* are characteristic, whereas ***Amanita aurantiovelata*** and ***Russula nothofaginea*** are outstanding for the forests located in the Depresión Intermedia. On the other hand, the *Nothofagus* forests of the Cordillera de los Andes did not present any exclusive mycorrhizal Agaric which could be used to characterize them. Finally, no species of the genus *Lactarius were found in any of the Nothofagus* forests studied by us, whereas the *Laccaria* species turned out to be the most common mycorrhizal taxa, being associated both to native as well as to exotic arboreal species.

In the *Nothofagus* forests studied in this work (see Table 1, 2 and 3) no saprophytic Agaric species common to all of them could be established. Besides, the percentage of this group of fungi in relation to the mycorrhizal species varies only slightly among these forests with the exception of Antillanca forest. From these results we cam conclude a good degradation of the vegetable remains. Finally, for the exception of some isolated *Armillaria species,* no parasitic agarics were detected, a fact that presumably points to a good health of these forests.

TABLE 1. Mycorrhizal and saprophytic *Agaricales s. l.* collected in Nothofagus forests of the Cordillera de la Costa.

Species	Cordillera Pelada	Popoén
Amanita diemii	(8, 10), M	(8, 11), M
Amanita rubescens	(-)	(11), M
Boletus chilensis	(-)	(11), M
Boletus loyita	(10), M	(-)
Boletus loyo = B. loyus	(10, 11), M	(11), M
Cortinarius austroacutus	(10, 11), M	(-)
Cortinarius austrolimonius	(8, 10, 11), M	(-)
Cortinarius austrosalor	(10, 11), M	(-)
Cortinarius flammuloides	(8, 10, 11), M	(11), M
Cortinarius horaki	(10), M	(-)
Cortinarius luteostriatula	(-)	(8), M
Cortinarius magellanicus	(8), M	(10), M
Inocybe fuscata	(-)	(8, 11), M
Laccaria laccata var. pallidifolia	(5, 8, 10), M	(-)
Laccaria ohiensis	(8, 10, 11), M	(-)
Laccaria proximella	(-)	(8, 11), M
Paxillus boletinoides	(11), M	(-)
Paxillus boletinoides f. olivacens	(9), M	(-)
Paxillus involutus	(-)	(7), M
Russula fuegiana	(8, 10, 11), M	(10), M
Stephanopus azureus	(8), M	(-)
Tricholoma cortinatellum	(-)	(8, 11), M
Tricholoma fusipes	(8, 10), M	(11), M
Tricholoma ustaloides	(-)	(11), M
Agaricus xanthodermus	(12), Sh	(12), Sh
Armillaria procera	(6, 9, 12, 13), Sltm	(6, 9, 12, 13), Sltm
Collybia butyracea	(-)	(-)
Collybia platensis	(9), Ss, Sh	(9), Ss, Sh
Crepidotus bullulifer	(5, 9,), Sl	(5, 9,), Sl
Entoloma incanus	(1, 8, 10), Sh	(1, 8, 10), Sh
Entoloma nitidum	(-)	(-)
Galerina patagonica	(1), Sltm	(1), Sltm
Hohenbuehelia patagonica	(-)	(-)
Hypholoma sublateritium	(13), Sltm	(13), Sltm
Hydropus dusenii	(10), Sltm	(10), Sltm
Marasmiellus alliodorus	(1, 9), Sltm	(1, 9), Sltm
Mycena albogrisea	(11), Sltm	(11), Sltm
Mycena chusqueophila	(3), Sl	(3), Sl
Mycena galericulata	(12), Sltm, Sltv	(12), Sltm, Sltv
Mycena metuloidifera	(-)	(-)
Mycena pura	(2), Sh	(2), Sh
Panellus longinquus	(2), Sl	(2), Sl
Pholiota spumosa	(-)	(-)
Pholiota sp.	(10), Sltm	(10), Sltm
Pleuroflammula croseosanguinea	(10), Sr	(10), Sr
Pluteus nanus	(-)	(-)
Pluteus spegazzinianus	(12), Sl	(12), Sl
Psathyrella falklandica	(12), Sl	(12), Sl
Tubaria furfuracea	(12), Sl, Sh	(12), Sl, Sh
Total Mycorrhizal species	16 (45.7%)	14 (51.8%)
Total Saprophytic species	19 (54.2%)	13 (48.1%)

(1) ***Aextoxicum punctatum***, (2) ***Amomyrtus luma***, (3) ***Chusquea quila***, (4) ***Eucryphia cordifolia***, (5) ***Fitzroya cupressoides***, (6) ***Laurelia phillipiana***, (7) ***Luma apiculata***, (8) ***Nothofagus alpina***, (9) ***N. antarctica***, (10) ***N. dombeyi***, (11) ***N. obliqua***, (12) woody remains of *Nothofagus* spp., (13) ***Weinmannia trichosperma***, (-) = not recorded.

TABLE 2. Mycorrhizal and saprophytic *Agaricales s. l.* collected in Nothofagus forests of the Depresión Intermedia.

Species	Rebellín	Los troncos
Amanita aurantiovelata	(7, 8, 9), M	(-)
Amanita diemii	(7, 8, 9), M	(7), M
Amanita merxmuelleri	(7), M	(-)
Cortinarius amoena	(-)	(7), M
Cortinarius albosinctus	(8), M	(-)
Cortinarius austroacutus	(3), M	(-)
Cortinarius austrolimonius	(7, 8), M	(7, 8), M
Cortinarius austrosalor	(7, 8), M	(7), M
Cortinarius flammuloides	(9), M	(7, 8), M
Cortinarius magellanicus	(7, 8), M	(7), M
Cortinarius olivaceobubalina	(9), M	(-)
Cortinarius pachynemeus	(7, 8), M	(-)
Cortinarius pugionipes	(7, 8), M	(-)
Cortinarius rubrobasalis	(7, 9), M	(-)
Inocybe erythrobasis	(7), M	(-)
Inocybe fuscata	(7), M	(7, 8), M
Laccaria laccata var. laccata	(7, 8, 9), M	(7, 8, 9), M
Paxillus boletinoides	(7, 8), M	(-)
Paxillus involutus	(9), M	(-)
Paxillus statuum	(8, 9), M	(-)
Porpoloma sejunctum	(7), M	(-)
Russula fuegiana	(7, 8, 9), M	(7, 8), M
Russula nothofaginea	(7), M	(-)
Tricholoma cortinatellum	(7, 8), M	(7), M
Tricholoma fagnani	(7), M	(-)
Tricholoma fusipes	(7, 8, 9), M	(7, 8), M
Xerocomus rubellus	(-)	(8), M
Agaricus xanthodermus	(10), Sh, Spr	(-)
Anthracophyllum discolor	(3, 4, 10), Sl, Srm	(-)
Armillaria montagnei	(7), Sltm	(10), Sltm
Armillaria sparrei	(-)	(10), Sltm
Conchomyces bursaeformis	(7, 8, 10), Srm	(-)
Crepidotus applanatus	(-)	(10), Sltm
Crepidotus bullilifer	(-)	(8), Sltm
Cheimonophyllum candidissimum	(6), Srm, Srv	(-)
Descolea antarctica	(2, 10), Sh, Sl	(-)
Galerina patagonica	(2, 5, 6, 7), Sltm	(10), Sltm
Gymnopilus chilensis	(10), Sltm	(10), Sltm
Hygrocybe araucana	(4), Sh	(-)
Hygrocybe conica	(3, 4, 5, 6), Sh	(10), Sh
Hypholoma sublateritium	(10), Sltm	(10), Sltm
Mycena atroincrustata	(10), Sltm	(-)
Mycena austrororida	(2, 3, 6, 7, 10) Srm, Sl	(10), Srm
Mycena chusqueophila	(-)	(1), Sl
Mycena galericulata	(7, 10), Sltm, Sltv	(7, 10), Sltm
Mycena helminthobasis	(10), Sltm, Sltv	(-)
Mycena metuloidifera	(10), Sltv	(-)
Panellus longinquus	(10), Sl	(-)
Pholiota aurivella	(7, 10), Sltm, Sltv	(-)
Pholiota variicystis	(5), Sltm	(-)
Pleuroflammula croceosanguinea	(7, 8), Sl	(-)
Psathyrella candolleana	(2, 10), Sltm, Sltv, Sh	(-)
Psathyrella chiloensis	(3), Sl	(-)
Psathyrella gracilis	(10), Sl	(-)
Total Mycorrhizal species	25 (52.1%)	12 (52.2%)
Total Saprophytic species	23 (47.9%)	11 (47.8%)

Chusquea quila, (2) ***Drimys winteri***, (3) ***Luma apiculata***, (4) ***L. gayana***, (5) ***Myrceugenia obtusa***, (6) ***M. pitra***, (7) ***Nothofagus dombeyi***, (8) ***N. obliqua***, (9) ***Nothofagus spp.***, (10) woody remains or humus of *Nothofagus* spp. (-) = not recorded.

TABLE 3. Mycorrhizal and saprophytic *Agaricales s. l* collected in Nothofagus forests of the Cordillera de los Andes.

Species	Antillanca
Amanita diemii	(9), M
Cortinarius austroacutus	(11), M
Cortinarius austrolimonius	(9, 11), M
Cortinarius austrosalor	(8, 10), M
Cortinarius choloides	(11), M
Cortinarius clorophanus	(11), M
Cortinarius egenus	(11), M
Cortinarius flammuloides	(11), M
Cortinarius fulvoconicus	(11), M
Cortinarius magellanicus	(9, 10 11), M
Cortinarius pachynemeus	(11), M
Cortinarius permagnificus	(11), M
Cortinarius pugionipes	(11), M
Cortinarius rubrobasalis	(11), M
Cortinarius squamiger	(11), M
Inocybe bridgesiana	(11), M
Laccaria ohiensis	(9, 11), M
Paxillus boletinoides	(8, 9, 11), M
Russula fuegiana	(10, 11), M
Tricholoma fallax	(9, 4), M
Tricholoma fusipes	(9, 10, 11), M
Agrocybe pediades	(13), Sh
Armillaria procera	(4, 5, 13, 14), Sltm
Armillaria sparrei	(10), Slm
Anthracophylum discolor	(6, 10), Sl, Srm
Cheimonophyllum candidissimun	(14), Sltm, Srm
Collybia dryophila	(11), Sl
Collybia subhybrida	(2, 3, 8,), Sl
Crepidotus applanatus	(13), Sltm, Sl
Crepidotus mollis	(9), Sltm, Sl
Entoloma incanus	(9, 13), Sh
Entoloma miceliosum	(11), Sltv
Galerina patagonica	(5, 7, 13), Sltm
Gerronema minutum	(11) Sh
Gymnopilus chilensis	(13), Sltm
Hydropus funebris	(11), Sh, Sltm
Hypholoma capnoides	(1, 4), Sltm
Hypholoma sublateritium	(5, 12), Sltm
Kuehneromyces cystidiosus	(11), Sltm
Marasmiellus alliodorus	(1, 4, 5, 13), Srm, Srv
Micronphale austrochilensis	(11), Srm
Mycena austrororida	(7, 10), Srm, Sltv
Mycena cyanocephala	(9, 11), Sltm
Mycena chusqueophila	(2, 3), Sl
Mycena epipterygia	(9, 11), Srm
Mycena galericulata	(9, 11), Sltm, Sltv, Srm
Mycena subulifera	(2), Sl
Panellus longinquus	(9, 10), Sl
Pholiota aurivella	(4, 9), Sltm, Sltv
Pholiota sp.	(9), Sltm
Pluteus cervinus	(13), Sl
Pluteus spegazzinianus	(9, 13), Sl
Psathyrella falklandica	(9), Sl
Total Mycorrhizal species	21 (40.4%)
Total Saprophytic species	31 (59.6%)

(1)***Aextoxicom punctatum***, (2), ***Chusquea uliginosa***, (3) *Chusquea* sp., (4) ***Eucryphia cordifolia***, (5) ***Laurelia philippiana***, (6) ***Luma apiculata***, (7) ***Myrceugenia exsucca***, (8) ***Nothofagus antarctica***, (9) ***N. dombeyi***, (10) ***N. obliqua***, (11) ***N. pumilio***, (12) ***Persea lingue***, (13) woody remains or humus of *Nothofagus* spp., (14) ***Weinmannia trichosperma***.

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PRELIMINARY LIST OF AQUATIC HYPHOMYCETES FROM CENTRAL BELARUS

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Abstract: Fifty four species of aquatic hyphomycetes are reported from watercourses of Central Belarus with notes on colonized substrates, frequencies of occurrence and maintained isolates. Of those, 15 species are reported from Belarus for the first time.

Key words: freshwater hyphomycetes, watercourses, distribution, Belarus.

Meaningful studies on aquatic hyphomycetes were not undertaken in Belarus until 1992. There is only a single paper reporting 13 species from watercourses of Minsk, the capital of Belarus (Stephanovich & Golubkov 1976).

Eighty four Belarus watercourses mainly located in Minsk region, in the Berezinsky Biosphere Reserve and in the National Park 'Golubye Ozera' were examined between 1992-1999. Submerged decaying substrates were collected and then incubated in standing distilled water in Petri dishes to induce sporulation (Webster & Descals 1981). Foam and scum samples were examined directly. Monoconidial isolates were obtained using routine isolation techniques and conidiation was stimulated by submerging strips of agar culture in standing or aerated distilled water.

Fifty four species of aquatic hyphomycetes were found during these studies (Tab. 1). Eleven of them were recorded also by Stephanovich & Golubkov (1976), 28 were published in our earlier contributions (Gulis & Stephanovich 1995, 1998a,b, Gulis & Marvanová 1998) and 15 are reported from Belarus for the first time. Two species seen by Stephanovich & Golubkov (1976) have not been found (*Dactylaria fusiformis* Shearer & J.L.Crane and *Tricladium patulum* Marvanová & Marvan). Five species appear undescribed (new spp. of *Anguillospora, Sporidesmium, Taeniolella* and *Tricladium*) and will be presented elsewhere.

The highest frequencies of occurrence (both FOW and FOS, see Tab. 1) were detected for *Anguillospora longissima* (96.4 % and 76.4 % respectively), *Tetracladium marchalianum* (81.0 % and 64.9 %) and *Alatospora acuminata* (70.2 % and 56.0 %). These species often dominate the aquatic hyphomycete communities also by number of conidia produced and, apparently, play an important role in leaf litter decomposition in freshwater. On the other hand, 59 % of the species appear to be rare (FOS <5 %); to some extent that may be caused by lack of long-term observations in the region.

Tab. 1. List of aquatic hyphomycetes found in watercourses of Central Belarus with notes on colonized substrates, frequencies of occurrence of species (%) and maintained isolates

Aquatic hyphomycete	**Substratum**	**FOW**	**FOS**	**MI**
Actinospora megalospora Ingold	P,Q,FS	7.1	3.1	2
Alatospora acuminata Ingold	Al,Ac,B,P,Q,S,T,U,G,W,UO,FS	70.2	56.0	3
* *A. flagellata* (Gönczöl) Marvanová	FS	1.2	0.5	-
A. pulchella Marvanová	Al,S,G,W,FS	4.8	2.1	2
Anguillospora crassa Ingold	Al,W,FS	10.7	7.3	2
* ? *A.* cf. *furtiva* J.Webster & Descals	Ac,FS	3.6	2.6	-
A. longissima (Sacc. & Syd.) Ingold	Al,Ac,B,F,P,Q,R,S,T,U,G,W,UO,FS	96.4	76.4	9
? *A. pseudolongissima* Ranzoni	Al,P,G,W	8.3	4.7	1
* *Anguillospora* sp. 1	Ac,G	2.4	1.0	4
* *Anguillospora* sp. 2	W	1.2	0.5	2
* *Arcispora bisagittaria* Marvanová & Bärlocher	FS	1.2	1.0	-
Articulospora tetracladia Ingold	Al,F,P,Q,T,G,UO,FS	9.5	6.3	6
Camposporium pellucidum (Grove) S.Hughes	W,UO	2.4	1.0	1
Clavariopsis aquatica de Wild.	Al,Ac,P,Q,S,T,U,G,W,FS	44.0	33.0	7
Clavatospora longibrachiata (Ingold) Marvanová & Sv.Nilsson	Al,Ac,P,Q,S,U,G,FS	26.2	19.9	3
* *Culicidospora gravida* R.H.Petersen	FS	1.2	0.5	-
Cylindrocarpon sp.	Al,S,T,W,UO	9.5	6.3	2
Dimorphospora foliicola Tubaki	Ac,W	2.4	1.0	2
Filosporella cf. *annelidica* (Shearer & J.L.Crane) J.L.Crane & Shearer	W	1.2	0.5	1
F. exilis Gulis & Marvanová	G,W,UO	3.6	2.1	8
F. versimorpha Marvanová *et al.*	G	8.3	3.7	4
Flagellospora curvula Ingold	Al,Ac,P,S,U,G,W,FS	42.9	27.7	3
* *Fusarium cavispermum* Corda	P,W,FS	11.9	8.4	6
Heliscella stellata (Ingold & V.J.Cox) Marvanová	Al,FS	8.3	6.3	2
Heliscus lugdunensis Sacc. & Théry	Al,Ac,P,S,U,W,UO,FS	25.0	17.8	5
* *Lateriramulosa uniinflata* Matsush.	FS	1.2	1.0	-
* *Lemonniera* cf. *alabamensis* Sinclair & Morgan-Jones	Al,FS	4.8	2.6	-
L. aquatica de Wild.	Al,Ac,B,F,P,Q,S,T,G,UO,FS	39.3	36.1	6
L. filiformis Dyko	Al,B,S,G,W,FS	4.8	4.2	3
L. terrestris Tubaki	Al,P,Q,S,U,FS	10.7	5.2	3

Tab. 1 (Cont'd)

Aquatic hyphomycete	Substratum	FOW	FOS	MI
Lunulospora curvula Ingold	Al	1.2	0.5	2
Margaritispora aquatica Ingold	Al,Ac,G,FS	10.7	5.2	4
Mycocentrospora acerina (R.Hartig) Deighton	FS	2.4	1.0	-
Porocladium aquaticum Descals	G,FS	3.6	2.6	3
* *Sporidesmium* sp.	P,G,W,UO	17.9	10.5	9
* *Taeniolella* sp.	UO	1.2	0.5	2
Tetracladium marchalianum de Wild.	Al,Ac,B,F,P,Q,R,S,T, U,G,W,UO,FS	81.0	64.9	7
Tetracladium maxilliforme (Rostrup) Ingold	FS	1.2	0.5	-
T. setigerum (Grove) Ingold	Al,B,F,P,Q,S,T,G,W, UO,FS	29.8	16.8	3
* *Tricellula aquatica* J.Webster	FS	3.6	1.6	-
Tricladium angulatum Ingold	Al,Ac,B,F,P,Q,R,S,U, G,W,UO,FS	42.9	32.5	6
? *T. anomalum* Ingold	FS	1.2	0.5	-
* *T. castaneicola* B.Sutton	FS	1.2	0.5	-
? *T. gracile* Ingold	Al,FS	6.0	3.1	-
T. splendens Ingold	Al,S,W,UO,FS	7.1	5.2	2
* *Tricladium* sp.	G	4.8	1.6	4
Triscelophorus monosporus Ingold	Al,P,S,T,G,W,FS	10.7	7.3	3
* *Triscelophorus* sp.	FS	2.4	1.0	-
Tumularia aquatica (Ingold) Descals & Marvanová	FS	1.2	0.5	2
Vargamyces aquaticus (Dudka) Tóth	Al,P,Q,R,U,G,W, UO,FS	25.0	14.7	7
Varicosporium delicatum S.H.Iqbal	G,UO	1.2	0.5	4
V. elodeae W.Kegel	B,S,G,FS	4.8	3.1	3
V. tricladiiforme A.Roldán & Marvanová	G,FS	23.8	12.6	6
Volucrispora graminea Ingold, P.J.McDougall & Dann	Al,FS	4.8	2.1	1
Total	-	-	-	155

Al = *Alnus glutinosa* (L.) Gaertn.; Ac = *Acer* spp., B = *Betula pendula* Roth; F = *Fraxinus excelsior* L.; P = *Populus* spp.; Q = *Quercus robur* L.; R = *Rhamnus cathartica* L.; S = *Salix* spp.; T = *Tilia cordata* L.; U = *Ulmus laevis* Pall.; G = grass blades; W = woody substrates; UO = unidentified or other substrates; FS = foam and/or scum.

FOW = frequency of occurrence in watercourses (84);
FOS = frequency of occurrence in pooled samples (191). Pooled sample consists of all substrates or foam/scum collected from a single locality at a particular time.
MI = number of maintained isolates.
* = new records for Belarus.

In Belarus watercourses aquatic hyphomycetes were commonly encountered on autumn-shed leaves of alder (*Alnus glutinosa*), poplar (*Populus* spp.) and willow (*Salix* spp.) — 26, 18 and 17 species, respectively. However, unexpectedly high species diversity was supported by grass blades and wood (25 and 23 species, respectively). Moreover, some rare species (*Filosporella* spp., *Anguillospora* sp. 1, *Porocladium aquaticum*, *Varicosporium delicatum*, *Tricladium* sp.) were found only on the above mentioned substrates. Some aquatic hyphomycetes were detected on substrates unusual for these fungi such as floating decaying leaves of *Nuphar lutea* (L.) Smith, *Potamogeton* spp., *Polygonum* sp., *Filipendula* sp., stems of *Equisetum* spp., needles of *Pinus sylvestris* L., onion scales, dead larvae of aquatic insects. Foam and scum which is a trap for aquatic organisms yielded the most diverse assemblage of aquatic hyphomycete conidia represented by 40 species.

Altogether 592 monoconidial isolates of aquatic hyphomycetes were obtained and studied. Of those 155 isolates (41 species) are maintained in the Culture Collection of the Department of Botany, Belarus State University and they are available on request. Some of the isolates according to Dr L.Marvanová (pers. comm.) cannot be assigned to any known species. Thus, they represent a valuable stock for future studies.

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PUCCINIA MESEMBRYANTHEMI CAUSING A NEW DISEASE INHIBITING THE GROWTH OF SCELETIUM TORTUOSUM IN SOUTH AFRICA

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ABSTRACT

Puccinia mesembryanthemi is newly reported as a rust disease of *Sceletium tortuosum* from Namaqualand and the south coast of South Africa. Although this pathogen has serious implications for the commercial cultivation of *Sceletium* spp., preliminary trials have given positive results with unregistered fungicides such as tebuconazole and bitertanol. *P. mesembryanthemi* is a pathogen also associated with other members of the family Mesembryanthemoideae.

Keywords: *Puccinia*, systematics, traditional medicine

INTRODUCTION

The genus *Sceletium* N.E. Br. is a member of the family Mesembryanthemoideae. It is characterised by several scrambling or clustered perennial species with flat, succulent leaves that remain as a skeleton in the dry season (Gerbaulet, 1996). *Sceletium* is indigenous to South Africa, and species occur in the Western, Eastern and Northern Cape Provinces, certain parts of the Knersvlakte, the Ceres Karoo, Namaqualand Rocky Hills, and along the south coast (Arnold & De Wet, 1993).

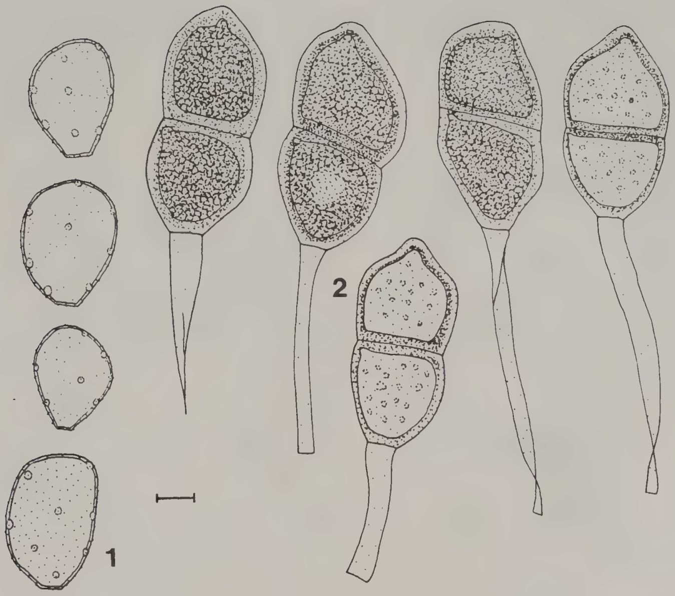
Sceletium, locally referred to as "kougoed", is traditionally used by some of the local inhabitants in Namaqualand as a medicinal plant. *S. tortuosum* (L.) N.E. Br. ex Schwantes has been used to relieve stomach aches, and as fodder for sheep during dry periods (Gerbaulet, 1996). Watt & Breyer-Brandwijk (1962) reported that farmers have used a decoction of *S. tortuosum* as a sedative, while it is also used as an intoxicant to relieve pain, or to increase one's strength.

Recently, a rust disease of *S. tortuosum* was brought to our attention by a local company, who claimed that it is associated with severe disease symptoms and losses in areas where this host plant is being multiplied for commercial uses. No rust diseases have been reported from *Sceletium* spp., although one species, *Puccinia mesembryanthemi* MacOwan is known from several genera in the Mesembryanthemoideae (Doidge, 1927, 1950). The aim of the present study was to identify this new rust pathogen, as well as to investigate possible ways of controlling the disease.

Using the keys developed by Cummins & Hiratsuka (1983), and the description and illustration provided by Doidge (1927), the rust disease on *Sceletium* was found to represent a new host record for *P. mesembryanthemi*. A morphological description based on the new collections is given below.

Puccinia mesembryanthemi MacOwan, in Syd., Monogr. Ured. **1**: 562 (1904). Figs 1-5.

Spermogonia and Aecia not observed on *Sceletium*. Aecia have been observed on *Mesembrianthemum*, and are described by Doidge (1927). Uredinia amphigenous, medium brown, scattered or in small groups, circular to slightly irregular, surrounded by a torn epidermis, 300-800 µm diam. Urediniospores broadly ellipsoid to globoid with



Figs 1, 2. *Puccinia mesembryanthemi.* **1.** Urediniospores. **2.** Teliospores. Bar = 10 µm.

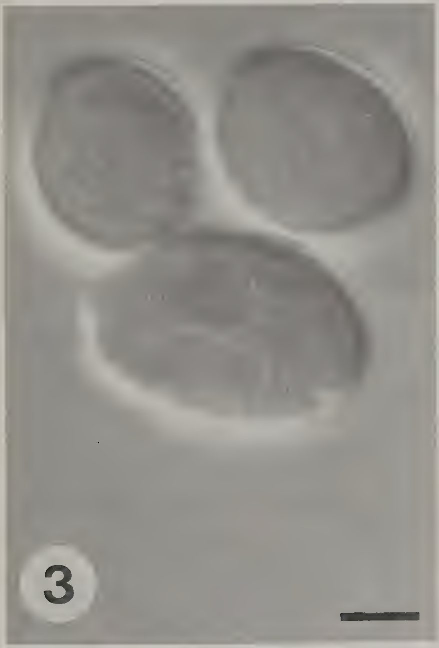
truncate bases, golden-brown, (25-)28-35(-38) x (20-)22-26 (-28) µm; wall 1.5-2 µm diam., inconspicuously echinulate, spines up to 1 µm long; pores scattered, circular, 6-10 per spore, 3-4.5 µm diam.; spines also present over pores. Telia amphigenous, scattered, 1(-3) mm diam., black, erumpent, cushion-like. Teliospores clavate, apex rounded or bluntly acute, attenuate towards the base, constricted at horizontal septum, medium brown, upper cell slightly darker than lower cell, (40-)50-60(-65) x (21-)26-28(-32) µm; upper cell subglobose to ellipsoid, (21-)26-28(-32) µm wide; lower cell cuneiform, (20-)22-25(-27) µm wide; wall smooth, 2-2.5 µm diam., thickened at apex (5-8 µm); germ pore apical in upper cell and just below the septum in lower cell; pedicel olivaceous, persistent, 10-110 µm long, 6-11 µm diam. at spore base.

Specimen examined. Namaqualand, Platbakkies, Kougoedvlakte Farm, (GPS reading: 30°-20-42' S and 18°-21-15' E), living leaves of *Sceletium tortuosum*, M. Scott, Nov. 1995, PREM 55338 (telia developed on this material after it was planted out in the Gouda district during May-June 1996).

Although numerous species of *Puccinia* have been described from diverse hosts in Southern Africa (Doidge, 1950), *P. mesembryanthemi* represents the first record of a disease on *Sceletium*. According to Cummins (1936), rust species with urediniospores that have numerous and scattered germ pores are representative of the more primitive forms. If this is indeed the case, it is possible that *P. mesembryanthemi* did not recently adapt to *Sceletium*, but has been present on this host for many years. It has only recently been perceived as a problem due to commercial farming of these species.

Control of pathogen. A preliminary trial was conducted in the nursery using six fungicides, namely copper oxychloride with nitrogen (Copper Count-N® ec; 5 ml/L), sulphur (Efekto Eco®; 4.3 g /L), mancozeb (Dithane 45® wp; 3 g/L), tebuconazole (Folicure® ec; 1.5 ml/L), bitertanol (Baycor® 300 ec; 1 ml/L) and triforine (Funginex® 190 ec; 1.5 ml/L). Plants were grown in a peat/vermiculite planting mixture in polystyrene trays (98 cavity size), with two replicate trays for each treatment, and one tray as a control. Trays were maintained in a greenhouse at temperatures that ranged from 12-35°C. Plants in each treatment were sprayed till run-off with a hand atomiser. Fungicides were applied every 7-10 days, and the amount of disease was visually assessed after 2 months. Plants were compared with the controls and rated as follows: (a) less rust pustules than the controls, (b) similar

Figs 3-5. *Puccinia mesembryanthemi*. **3.** Urediniospores. **4.** Surface view of urediniospores showing spines and pores (arrows). **5.** Teliospores. Bars = 10 µm.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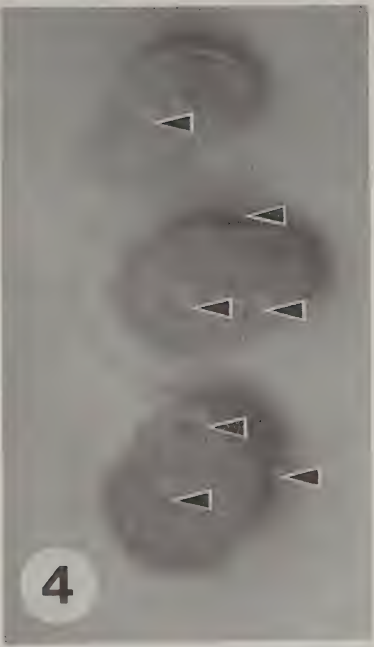
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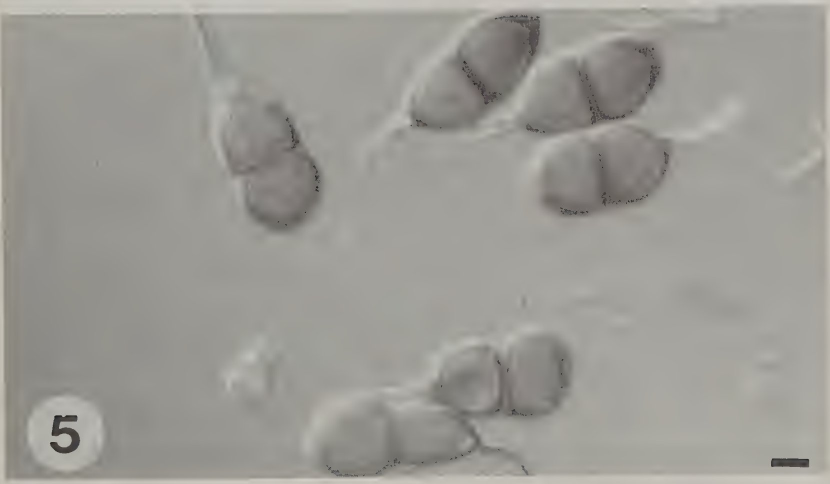
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amount of rust pustules to that of the controls, (c) more rust pustules than the controls, and (d) seedling death. From the preliminary data obtained in this study, only tebuconazole and bitertanol applications led to a marked reduction in disease (approximately 50 %) compared with the controls. Further evaluation of these compounds under field conditions is presently underway.

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THREE NEW SCOLECOSPOROUS HYPHOMYCETES FROM WATERS IN BELARUS

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Abstract: Three new species of hyphomycetes are described from aquatic habitats in Belarus: *Anguillospora rubescens* has reddish colonies and long, needle-shaped, almost straight conidia formed on percurrent conidiogenous cells; *Sporidesmium fuscum* is dematiaceous and has straight cylindrical conidia produced on percurrent conidiogenous cells. *Taeniolella typhoides* is also dematiaceous and produces dark brown thick-walled conidia singly or in short chains. These fungi were isolated from submerged decaying herbaceous plants, tree leaves and corticated or decorticated wood.

Key words: Taxonomy, freshwater hyphomycetes, streams.

Introduction

While surveying aquatic hyphomycetes of Belarus, several new or interesting scolecosporous species have been isolated. One of them, *Filosporella exilis* Gulis & Marvanová (1998) have been recently described as new. Three others are presented in this paper.

Material and Methods

All material in nature was collected in watercourses of Minsk region unless otherwise stated by the first author, who also isolated the fungi into monoconidial pure cultures. The labelling VG-119, VG-155 etc. refers to living cultures, the IMI numbers denote herbarium material. The colony colours were determined after Rayner (1970). Sporulation was observed in distilled water (standing cultures at 15 or 10 °C or aerated cultures at 18 °C, sometimes followed by standing culture incubation). Pigment production was observed on 2% malt agar (Difco) or on CYA (Pitt 1979).

Descriptions

Anguillospora rubescens Gulis & Marvanová sp. nov. Fig. 1, Pl. I

Etym.: *rubescens* (Lat.) = becoming reddish. Refers to the production of reddish pigment.

Fungi mitosporici, Hyphomycetes, Moniliaceae. Teleomorphosis ignota.
Coloniae modice crescentes, gossypinae, griseobrunneae, postea in parte reversa pigmentum vinaceum producentes. Corpuscula sclerotialia mollia adsunt. Fructificatio copiosa, subaquatica, structurae conidiogenae parietibus subfuscis. Conidiophora lateralia vel terminalia, typice brevia, dispersa vel aggregata, nonnumquam caespitosa, simplicia vel basi parce ramosa. Cellulae conidiogenae incorporatae vel discretae, cum elongationibus percurrentibus nonnullis praeditae. Conidia recta vel paulo curvata, longifusoidea, (120-) 260-440 (-570) x 3.5-5.5 (-7) µm, apice subulata, basi truncata vel cum extensione percurrente praedita, usque ad 40 septata, cum parietibus sinuosis. Secessio schizolytica.
Holotypus: IMI 380375, ex VG-119.

Mitosporic fungi, moniliaceous hyphomycetes. Teleomorph unknown.
Colonies (MA 2 %) growing moderately fast, reaching 12-13 mm diam. in 10 d at 15 °C, pale purplish grey, becoming darker with age, reverse brown vinaceous with a dark brick margin. On CYA the colony is livid vinaceous to pale vinaceous, with concentric pale grey rings, reverse chestnut in the centre, with a red concentric outer zone and a saffron margin. Aerial mycelium cottony, abundant. Hyphal aggregations or soft prosenchymatic sclerotial bodies of thin-walled hyphae form on agar after submergence. Sporulation profuse after two days, below water, in standing or aerated distilled water. Conidiogenous structures have pale fuscous walls, which is more pronounced in aged cultures. Conidiophores micro- to semimacronematous, single or densely aggregated, often forming scattered tufts or loose conidiomata on sclerotial bodies, typically short, simple or rarely with a few basitonous branches, intercalary, lateral or terminal. Conidiogenous cells integrated with conidiophores as well as with conidial initials or discrete, later usually with few short, percurrent elongations. Conidia long-fusoid, straight or faintly curved, (120-) 260-440 (-570) x 3.5-5.5 (-7) µm, up to 40 septate, often with slightly wavy outline; apex subulate, base truncate after secession, often with an inconspicuous frill, later typically with percurrent, rarely excentric subulate extension sometimes slightly bulbous just below the basal conidial scar, up to 45 x 2.5-4.5 µm. Slimy coating visible due to granular deposits (Fig. 1,J) on its surface may be present on both ends of floating conidia. Conidial secession schizolytic.

We revealed new growth occurring on both ends of conidia after secession: on the distal end the new hyaline cell wall merges imperceptibly with the slightly fuscous old one; at the proximal end a distinct discontinuity of the cell wall or even a very short frill is seen around the basal conidial scar (Fig. 1,K). With the light microscope it is not possible to distinguish whether the discontinuity involves both inner and outer cell wall layers or solely the outer ones.

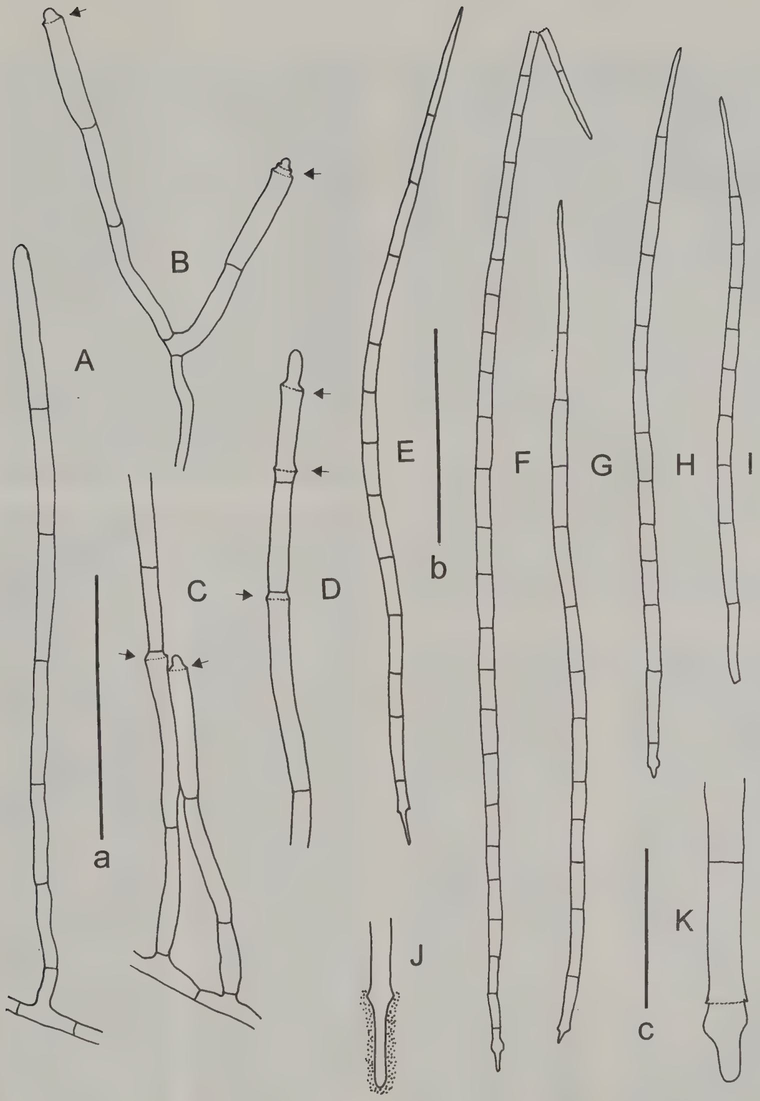
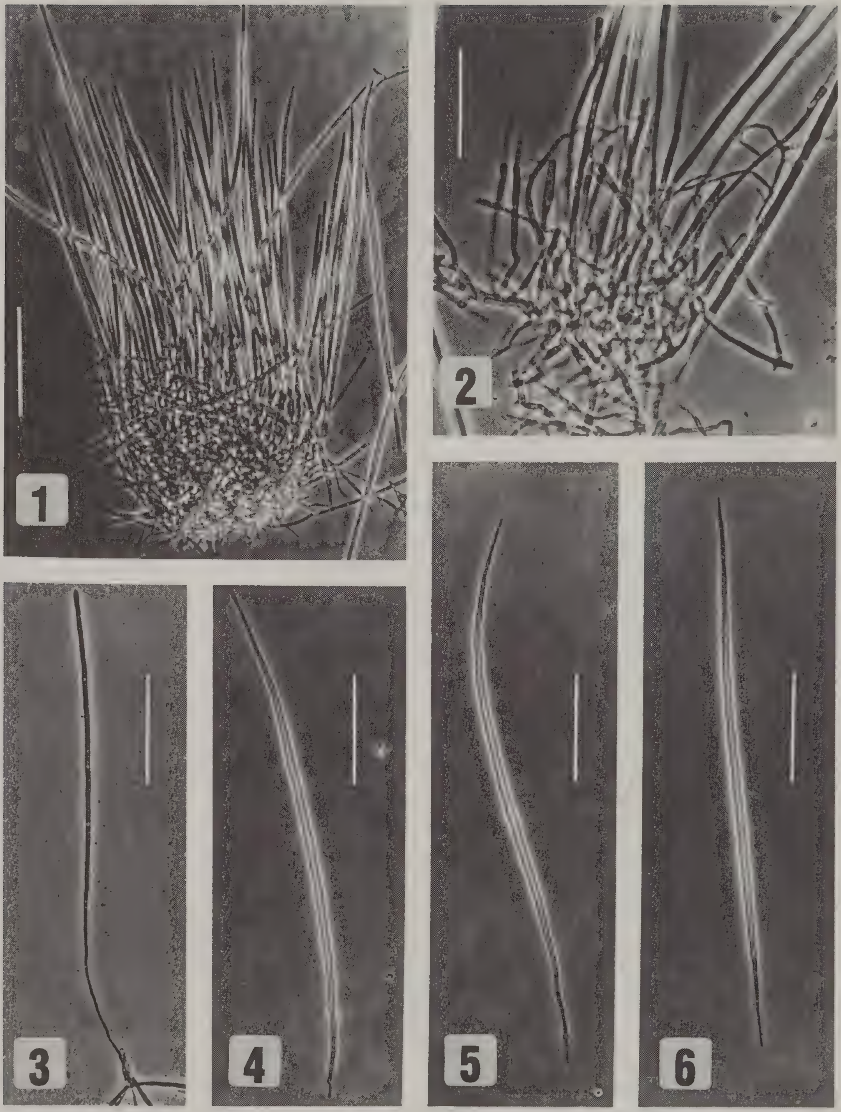


Fig. 1. *Anguillospora rubescens*, VG-119. A. Developing conidium. B-D. Conidiophores with percurrent proliferation of conidiogenous cells (arrows). E-I. Detached conidia. J. Percurrent extension on conidial base coated with mucous sheath. K. Detail of conidial base showing inconspicuous frill (remnant of conidial cell wall) and slightly inflated percurrent basal extension. Scale bar a = 50 µm (for A-D, J). Scale bar b = 100 µm (for E-I). Scale bar c = 25 µm (for K).



Pl. I. *Anguillospora rubescens,* VG-119. 1. Conidioma formed in water. 2. Detail of conidioma. 3. Developing conidium. 4-6. Detached conidia. Note the variously formed basal extensions: excentric (4), percurrent from a bulbous base (5), percurrent integrated (6). Scale bar for 1,3-6 = 100 μm, for 2 = 50 μm.

Specimens examined: VG-119, river Nacha near the village Kladi, on submerged decaying grass blades collected on 20 Apr. 1997. VG-154, VG-155 (IMI 380381), VG-156, stream near the village Komarovo, on submerged decaying leaves of *Acer negundo* L. collected on 25 Oct. 1997.

This species differs from the well known members of *Anguillospora* Ingold by the combination of typically straight long-fusoid conidia between 260 and 440 μm long with subulate ends, which lack intercalary attenuations.

The pigment and the long conidia suggest a possible identity with *Anguillospora gigantea* Ranzoni. Unfortunately no type material of *A. gigantea* has been deposited and the drawings in the protologue do not show much details. However, there are also substantial differences between our material and *A. gigantea*: the latter has sigmoidly curved spores; even when the curvature is not strong, it appears on the drawings (Ranzoni 1953, Figs. 1 K and 3 B-G) and is described in the protologue: »The curvature is not always restricted to one plane, so that... it is more or less sigmoid...». The sclerotial bodies of thick-walled hyphae are claimed to give rise to loose sporodochia when submerged and may resemble the soft sclerotia of our fungus. However, in *A. rubescens* these appear only after submergence and no tissue of thick-walled hyphae has been seen before or after submergence. In our species curved conidia are less common and appear in aged cultures of some isolates only.

Ecologically, *A. gigantea* seems to prefer warmer months in California (in latitudes between 32-42 N) where it »was found only during the summer and early fall months», whereas our fungus was collected in April and October in a cool climate area (54-55 N)). Therefore we hesitate to choose our fungus as a neotype of *A. gigantea.*

Our species is somewhat similar to *A. longissima* (Sacc. & Syd.) Ingold, where some isolates also produce reddish pigment, the conidia tend to proliferate at the ends after secession and unlike *A crassa* Ingold, *A. furtiva* Descals & J.Webster (Descals et al. 1999) and *A. fustiformis* Marvanová & Descals (1996) lack the shiny appearance, believed to be due to glycogen reserves. *A. rosea* Descals & J.Webster (Descals et al. 1999) has pale pinkish colonies and the conidia are typically sigmoidly curved, parallel-walled, have no basal extension and the ends are rounded.

Conidia of our fungus are also similar to those of *Pseudoanguillospora stricta* Iqbal, but the conidiogenous cells of the latter proliferate sympodially (Marvanová 1996), the conidia rarely show any postsecessional growth and the colonies lack reddish pigment. *Kontospora halophila* A.Roldán, Honrubia & Marvanová produces apparent red pigment in culture, but its conidia are wider and often bear lateral caducous branches. The fungus occurs in waters with high content of mineral salts (Roldán et al. 1990). The caespitose conidiomata with long acicular conidia in *A. rubescens* resemble fructifications of *Linodochium formosum* Minter & Hol.-Jech. but the latter has conidiogenous cells grouped at conidiophore apices, with 1-3 conidia arising more or less synchronously at each conidiogenous cell. Moreover, members of this genus seem to prefer coniferous substrates (Minter & Holubová-Jechová 1981).

Sporidesmium fuscum Gulis & Marvanová sp. nov. Fig. 2, Pl. II, 1-3
Etym.: *fuscum* (Lat.) = fuscous.

Fungi mitosporici, Hyphomycetes, Dematiaceae. Teleomorphosis ignota.
Coloniae modice crescentes, griseae, gossypinae, pars reversa atra. Parietes cellularum fuscae. Conidiophora micro- vel semimacronematosa, terminalia vel lateralia, nodosa, usque ad 450 μm longa, simplicia vel parce ramosa. Cellulae conidiogenae incorporatae, percurrenter prolificantes, apud locos conidiogenos saepe inflatae. Conidia singularia, simplicia, recta, cylindrica, (90-) 130-220 (-330) x (3.5-) 4-5.5 μm, 12-18 (-23) septata, apex cupulatus, basis truncata. Septa praecipue transversa, rarissime obliqua, crassa vel tenua. Extensio basalis rara, brevis, excentrica. Secessio schizolytica, tarda.

Holotypus: IMI 380377, ex VG-80.

Mitosporic fungi, dematiaceous hyphomycetes. Teleomorph unknown.
Colonies (MA 2 %) 52 mm diam. in 35 d at room temperature, or 5-12 mm diam in 13 d at 15 °C, mouse grey, sometimes darker in the centre and paler at the margin, aerial mycelium abundant, cottony, becoming lower and less dense towards the colony margin, reverse leaden or fuscous black. Cell walls fuscous. Sporulation underwater and at the water level. Conidiophores micro- to semimacronematous, terminal or lateral and then up to 450 μm long, simple or sparsely branched, often nodose. Conidiogenous cells integrated with the conidiophore, proliferation percurrent, usually followed by symmetrical or asymmetrical swelling below the site of conidium detachment, in the second case giving an impression of sympodial elongation. Conidia single, simple, straight, cylindrical, integrated with the conidiogenous cell, (90-) 130-220 (-330) x (3.5-) 4-5.5 μm with 12-18 (-23) septa, rounded at the apex, truncate at the base. Septa of two kinds: thicker, more or less alternating regularly with thin ones, mostly transverse, very rarely oblique. Basal extension rarely present and then short, excentric, resembling a germ-tube. Formation of secondary lateral conidia seen occasionally. Conidial secession schizolytic, tardy. Fragmentation of conidia into few-celled segments takes place after prolonged incubation in water.

Specimens examined: VG-63, in a hardwater stream near the village Raubichi, on submerged decaying twigs collected in Sep. 1994. VG-80, in a hardwater stream, right tributary of the river Berezina near the village Schatkovo, Bobruisk region, on submerged decaying leaves of *Populus nigra* L. collected in May 1996. VG-81 (IMI 380378), the same locality and date, from submerged decorticated wood. VG-94, in a stream without woody riparian vegetation, near the village Selivanovka, on submerged decaying grass blades collected in Oct. 1996. VG-118, VG-124 (IMI 380383), in the slow-flowing river Muzhanka near the village Zamuzhanje, on submerged decorticated wood collected on 20 Apr. 1997. VG-123 (IMI 380376), in the slow-flowing river Ptich near the village Voronichi, on submerged decaying leaves of *Nuphar lutea* (L.) Smith collected on 22 Apr. 1997. VG-125, in a stream near the Village Velikoje Selo, on decaying submerged grass blades collected on 15 May 1997. VG-136, in the river Berezina, the Berezinsky Biosphere Reserve, on submerged decaying wood collected on 10 Oct. 1997.

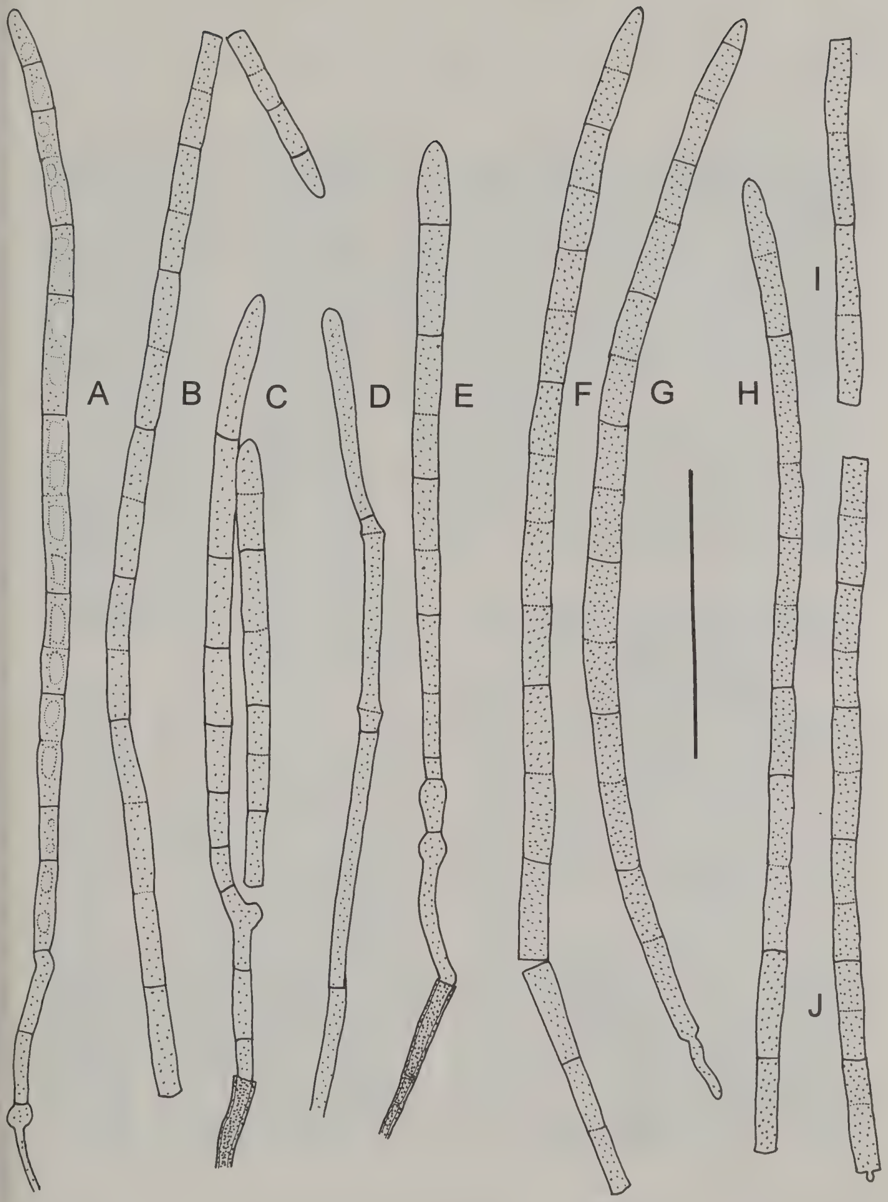
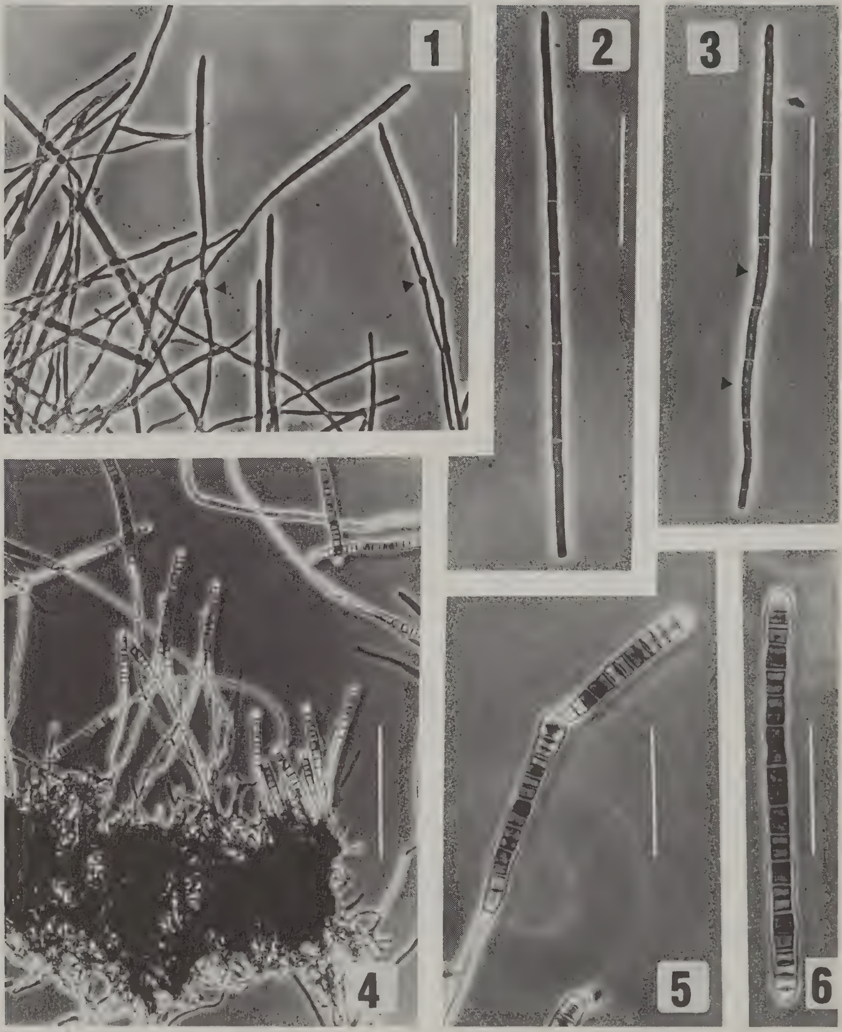


Fig. 2. *Sporidesmium fuscum*, VG-80. A,C-E. Developing conidia on conidiophores. In C and E the conidiophores emerge from old brown thick-walled hyphae. B, F-H. Detached conidia. I, J. Part-conidia. Scale bar = 50 µm.



Pl. II. *Sporidesmium fuscum,* VG-80. 1. Developing conidia. Note the nodose proliferations (arrowheads). 2, 3. Detached conidia. Note the thin septa alternating with thick ones (arrowheads). Scale bar for 1-3 = 50 µm. *Taeniolella typhoides,* VG-126a. 4. Group of developing conidia. 5. Conidiophore with a primary and a secondary conidium. 6. Detached conidium. Scale bar for 4 = 90 µm, for 5, 6 = 45 µm.

Four isolates of this species (VG-63, VG-80, VG-81 and VG-94) produce black soluble pigment in stationary liquid culture (potato maltose broth). Culture filtrates showed antimicrobial activities against Gram-positive bacteria (Gulis & Stephanovich 1999).

This species was originally reported as *Mycocentrospora varians* R.C.Sinclair & Morgan-Jones (Gulis & Stephanovich 1996). However, a thorough study of the conidiogenesis revealed percurrent proliferation of conidiogenous cells, which bars classification in *Mycocentrospora* Deighton. Search in literature led us to *Sporidesmium* Link in the broad sense as understood by Ellis (1958, 1971, 1978). It is saprotrophic, dematiaceous, has percurrently proliferating conidiogenous cells and transversely septate conidia. Kirk (1982) segregated *Sporidesmiella* P.M. Kirk with distoseptate conidia and Subramanian (1992) split the rest of *Sporidesmium* into six genera. As generic criteria he used combinations of conidial septation (eu- or disto-), conidiophore proliferation and the shape of conidiophore segments resulting from the proliferations. However, the genus is still rather heterogeneous, comprising species with various conidial shapes: clavate, obclavate, long-fusoid or cylindrical, with thick or thin cell walls. Percurrent proliferations of conidiophore marked by inflations around the detachment scars is characteristic for *Gangliophora* Subram. based on *Sporidesmium casuarinae* Matsush., but the conidiophores in our fungus are much less and only rarely branched, conidia are longer and less wide. *Sporidesmium fragmentisporum* Matsush. (Matsushima 1993) described from a decaying palm petiole collected in a National Park in Equador (no closer data on the habitat given) is the most similar species to our taxon: it has semimacronematous conidiophores with percurrently proliferating conidiogenous cells, often inflated and asymmetrical at the point of inflation and conidia fragmenting into smaller units. Like our fungus, it also has thicker and thin septa (not mentioned in the description, but see Matsushima 1993, fig. 565 and Pl. 205). However, it differs by having much shorter conidiophores as well as conidia (only up to 85 µm, which is below the lower limit of *S. fuscum*). At the same time we are aware of the marginal position of *S. fragmentisporum* in the genus *Sporidesmium* and its eventual segregation together with *S. fuscum.*

Members of *Sporidesmium* often occur on woody substrates or on decaying plant tissues. Several species are already described from water habitats: *S. ensiforme* Descals (1982), *S. taxodii* J.L.Crane (Crane 1972), and four new species by Cabello et al. (1990), who also reported some species from a river hitherto known from terrestrial habitats only. The name of another species suggests at least moist habitat, i.e. *S. paludosum* M.B.Ellis (Ellis 1958) described from decaying leaves and culms of *Cladium mariscus* (L.) Pohl which is a swamp-inhabiting plant. Abdullah (1980) found *Sporidesmium flexum* Matsush. on *Thuja plicata* foliage collected from the bottom of a small pond. Three of the above species (*S. ensiforme, S. longisporum* Cabello, Cazau et Arambarri and *S. taxodii*) are similar to our in the long conidia. However, *S. ensiforme* has conidia at least twice as long as our species, in *S. longisporum* the conidia are significantly shorter, distinctly tapering towards apex and distoseptate. *S. taxodii* has shorter and wider long-fusoid conidia.

Taeniolella typhoides Gulis & Marvanová sp. nov. Figs. 3,4, Pl. II, 4-6

Etym.: *Typha* = cat tail, reed mace, *-oides* means 'similar to'. Refers to the impression the attached conidia give when seen under low magnification.

Fungi mitosporici, Hyphomycetes, Dematiaceae. Teleomorphosis ignota.
Coloniae modice crescentes, griseae, gossypinae, pars reversa atra. Conidiophora dispersa vel aggregata, micro- vel semimacronematosa, simplicia, glabra vel verrucosa. Cellulae conidiogenae incorporatae. Prolificatio non visa. Conidia singularia vel nonnumquam in catenis acropetalibus curtis oriunda, recta vel paulo curvata, cylindrica, (35-) 118-243 x 8-11 µm, usque ad 40 septata, apice rotundata, basi truncata vel convexa, raro cum extensione parabasali excentrica. Cellulae subinflatae, parietibus crassis, glabris vel verrucosis, segmenta breviora atrobrunnea, cellulae terminales pallescentes. Sporulatio subaquatica. Secessio conidiorum tarda, schizolytica.

Holotypus: IMI 380380, ex VG-126a.

Mitosporic fungi, dematiaceous hyphomycetes. Teleomorph unknown.
Colonies (MA 2 %) 23-26 mm diam. in 14 d at 15 °C, lavender grey to pale olivaceous grey, aerial mycelium cottony, reverse dark olivaceous grey. After several months incubation under water, minute sclerotial bodies ca. 100 µm diam. with radiating hyphae at the margin appear at the bottom of the Petri dish. Sporulation underwater, in stationary cultures or after a several-day aeration followed by submerged incubation in standing distilled water. Conidiophores micro- or semimacronematous, intercalary, lateral or apical and then sometimes extremely long, scattered or aggregate, simple, glabrous or verrucose in the proximal part. Conidiogenous cells integrated with supporting structures, proliferation not seen. Conidia single or sometimes in short acropetal chains, straight or somewhat curved, cylindrical, (35-) 118-243 x 8-11 µm, up to 40 septate (in nature up to 470 x 9-14 µm, up to 60 septate), rounded at the apex, truncate or convex at the base, sometimes with a thinner hilum on one or both ends, rarely with an excentric basal extension. Cells slightly inflated, walls thick, brown, glabrous or sometimes verrucose, few-celled segments occasionally dark brown, the uppermost cell typically paler. Thin secondary (?) septa may be present, but not regularly. Secession schizolytic, tardy in stationary culture, after several months of submergence.

Specimens examined: VG-126 (IMI 380382), VG-126a, in the slow-flowing river Ptich near the village Voronichi, on submerged decaying leaves of *Nuphar lutea* (L.) Smith collected on 22 Apr. 1997.

The anamorph genus *Taeniolella* S.J.Hughes (1958) is relatively broadly defined. Conidia are typically flexuous, less often straight, simple or branched, catenate with inflated, glabrous or verrucose cell walls. *Taeniolella* spp. are typically terrestrial and are usually collected on woody debris, rarely on leaves, herbaceous stems or mushrooms (Ellis 1971, 1976). Several species were described as parasitic on lichenized fungi (Hawksworth 1979, Diederich 1990). Four species were reported from water environments: *Taeniolella aquatilis* (Woron.) Mil'ko (1985) from water in the river Volga in Russia, *T. americana* J.L.Crane & Schokn. (Crane & Schoknecht 1982) from submerged decaying catkin of *Liquidambar styraciflua* L. in a pond in North America

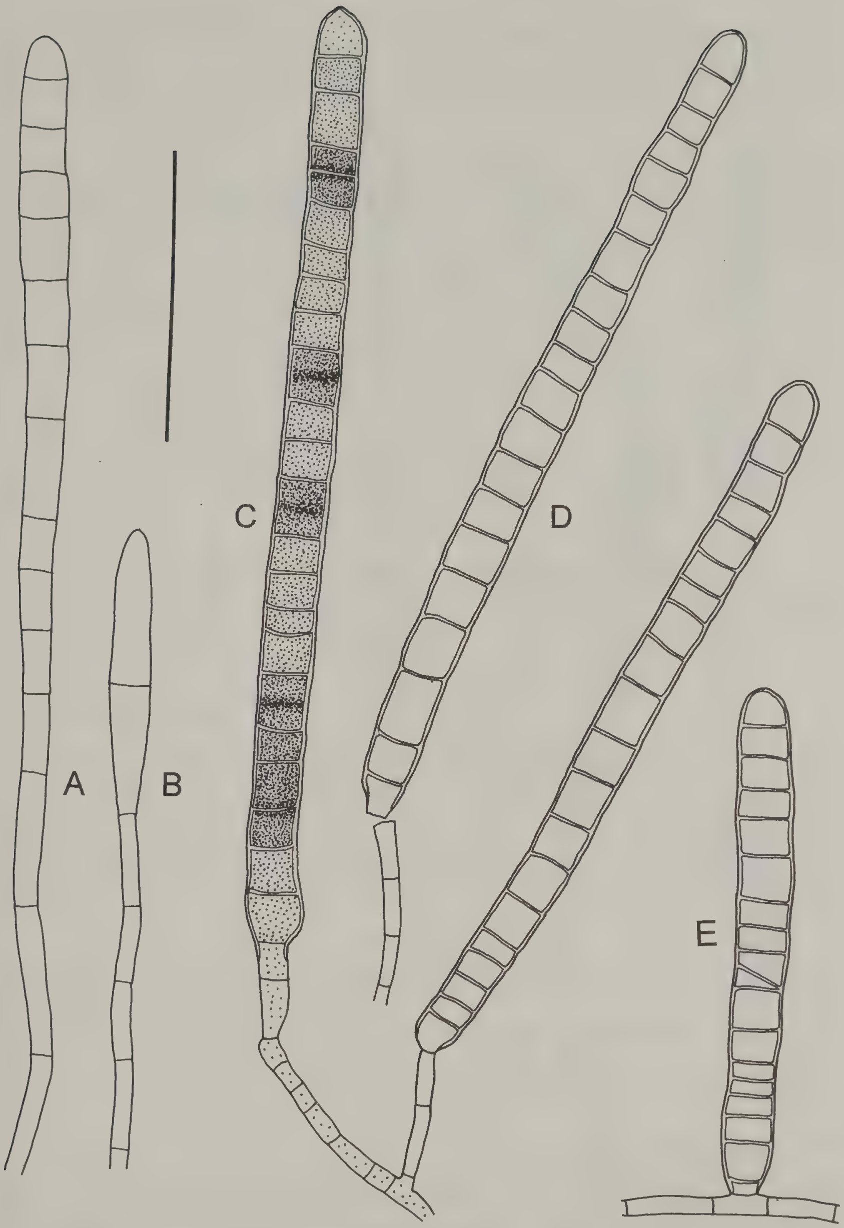


Fig. 3. *Taeniolella typhoides,* VG-126a. A,B. Young stages of conidial development. C. Conidia on branched conidiophore. D. Detached conidium near its conidiophore. E. Sessile conidium on intercalary conidiogenous cell. Scale bar = 50 µm.

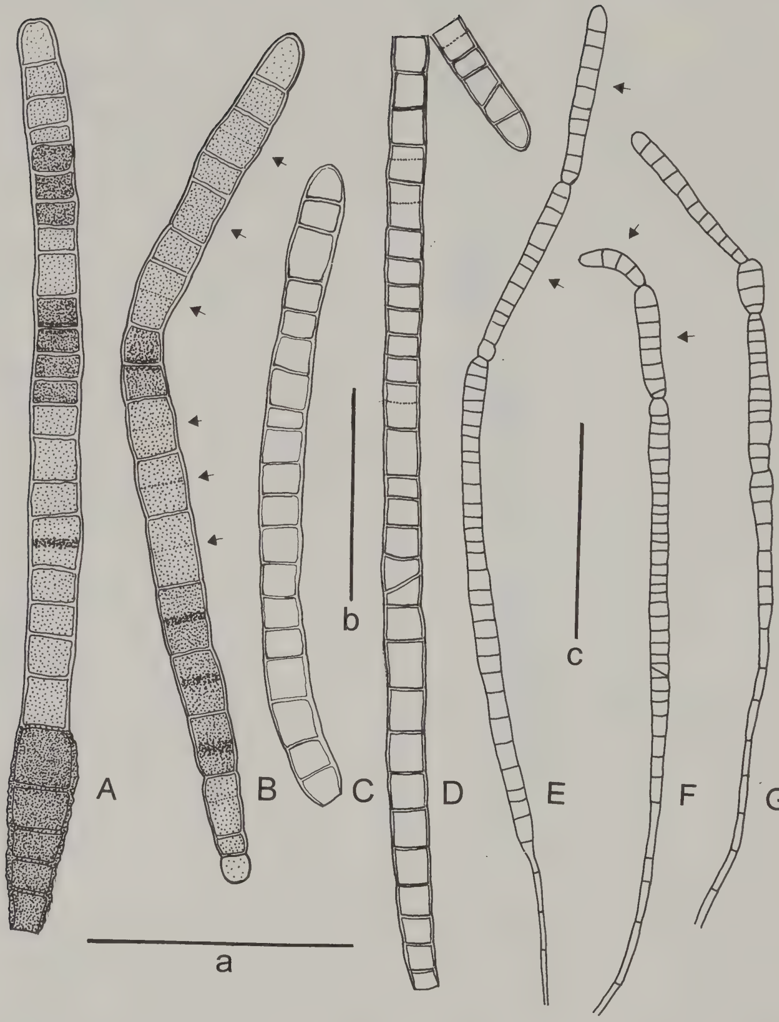


Fig. 4. *Taeniolella typhoides.* A-C. VG-126a. Detached conidia. Note the dark rough segments in A and B, and thin secondary (?) septa in B (arrows). D. Conidium from nature. Compare the length of this conidium with conidia from pure culture. E-G. VG-126a. Apical chains of secondary conidia developing *in situ* (arrows). Scale bar a = 50 µm (for A-C), scale bar b = 50 µm (for D), scale bar c = 100 µm (for E-G).

(cf. Shearer & Crane 1986), *T. caffera* Matsush. (Matsushima 1996) from submerged decaying branch in a stream in South Africa and *T. rudis* (Sacc.) S.J.Hughes from decaying submerged *Comarum palustre* L. and *Phragmites australis* (Cav.) Trin. ex Steud. in a lake in Estonia (Voronin 1992).

Our species differs from all described spp. of *Taeniolella* by the capacity to produce much longer conidiophores, which is probably an adaptation to the water environment or may represent only cultural conditions. Most of the *Taeniolella* species were described from natural substrates and their morphology in pure culture is not known. Thinner secondary septa are drawn in *T. exilis* (Karst.) S.J.Hughes (Ellis 1971) but not mentioned in the description. *T. aquatilis* has twice as short conidia as in our species and they are usually only 6-14 septate. *T. americana* differs from our species by straight, rough, uniformly brown conidia which are twice as wide as in our fungus but have the same length and appear in long sometimes branched chains. *T. caffera* is much more similar to our species in producing persistent or tardily breaking chains of conidia, but its conidia are more curved, reaching half the length of those of *T. typhoides* and have glabrous cell walls. All septa are drawn equally thick (Matsushima 1996, Figs. 870, 871).

Truly dematiaceous genera (with dark, often thick conidial cell walls) occur rarely among freshwater hyphomycetes with exclusively or predominantly underwater sporulation. The melanized, usually thick structures may be a protection against damages from invertebrate feeding or bacterial lysis.

Acknowledgements

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A NEW MYCOVELLOSIELLA SPECIES ON MYRACRODRUON URUNDEUVA

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Abstract

Mycovellosiella myracrodruonis sp. nov. is described on leaves of *Myracrodruon urundeuva* (Anacardiaceae). The new species was compared to another *Mycovellosiella* species, and also to three *Phaeramularia* species on Anacardiaceae and shown to be different on the basis of secondary mycelium, stroma, conidia and conidiophore morphology.

Keywords: tropical fungi, hyphomycete, cercosporoid fungi, Cerrado, Neotropica.

Introduction

Although cercosporoid fungi are common in Brazil, detailed systematic studies only started in late 1900's (Viégas, 1945) followed by A.C. Batista and collaborators (Silva & Minter, 1995). Recently, several papers were published dealing with *Cercospora*-like fungi collected from a wide host range in Brazil (Dennis, 1970; Ferreira, 1989; Muchovej & Ferreira, 1981; Dianese & Câmara, 1994; Medeiros & Dianese, 1994; Inácio *et al*., 1996; Dianese *et al*., 1996; Crous *et al*., 1997; Crous & Câmara, 1998; Inácio & Dianese, 1998; Dianese *et al*., 1999).

Myracrodruon urundeuva Fr. Allem. [= *Astronium urundeuva* (Fr. Allem.) Engl.] (Anacardiaceae), a unique hardwood commonly known as "aroeira", was recently shown to be susceptible to an intensive leaf spotting initially attributed to an unknown *Phaeoramularia* species (Dianese & Inácio, 1995). A re-evaluation of previous and fresh collections in the present study, however, has revealed that this fungus is actually representative of a new *Mycovellosiella* which is here illustrated and described.

Materials and Methods

Samples of *M. urundeuva* showing intense leaf spotting caused by an unknown cercosporoid fungus were collected from seedlings being grown in a nursery located in Brasília, Distrito Federal. Branches containing affected leaves were dried, numbered, and deposited in the Coleção Micológica de Referência da Universidade de Brasília (Herbarium UB, mycological collection). After an initial examination under a stereomicroscope a series of microtome sections were made to document the location of the mycelium and stromata within the host tissue. Slides were prepared from these sections and also from fungal structures and conidia taken directly from the leaf spots. Measurements and microphotograph documentation were done using a Zeiss Axiolab light microscope. Leaf pieces containing caespituli were observed by scanning electron microscopy (SEM) after fixation in sodium cacodylate buffer, pH 7.4, 0.1 M, containing 2% glutaraldehyde, for at least 24 h. The samples were dehydrated in an aqueous series with acetone concentrations increasing from 15, 30, 50, 75, and 100%, for 15 min at each concentration. Leaf pieces were critical point dried, covered by a thin layer of gold in a sputter coater for 2 min, and examined using a Jeol (JSM 840-A E, Japan) SEM.

Taxonomy

Mycovellosiella myracrodruonis Inácio & Dianese sp. nov. (Figs 1-8)

Laesiones usque 15 mm diam., amphigenae, circulares vel irregulares, coalescentes, atro brunneae, mortuascentes in centro cinerascentes.

Mycelium primarium immersum; hyphis palido brunneis, septatis, 2-4 µm diam. *Mycelium*

secundarium superfiale, amphigenum, saepe hypophyllum; hyphis septatis, ramosis, palido bruneis, aliquando per stomata emergentes, saepe ex stromata formantes, conidiophora lateraliter gerentes. *Stromata* 14-67 μm profunda x 24-60 (-90) diam., subepidermalia, amphigena, erumpentia, brunnea, texturis angularibus; cellulis 3-8 μm diam. *Conidiophora* 19-68 x 2-4 μm, brunnea, 0-7 septata, recta usque leviter curvata, aliquando ramosa, aliquando geniculata, laeves, sympodiales, ceaspitosa, amphigena; cicatricibus conspicuis. *Cellulae conidiogenae* laeviae, polyblasticae, integratae, sympodiales, terminales vel intercalares, cicatricibus conspicuis. *Conidia* 14-85 x 2-5 μm, 0-4(-6) septata, non constricta, saepe catenata, modice olivacea vel palido brunnea, laevia, obclavata vel subcylindrica, recta usque modice curvata, obconicis truncatis prope basin; cicatricibus conspicuis saepe amphiginis.

Specimina examinata: In foliis vivis *Myracrodruonis urundeuvae* (Anacardiaceae), Viveiro 2, Novacap, Asa Norte, Brasília, DF, Brazil; 12 May 1995; leg. C. A. Inácio 292; UB (col. mycol.) 8767 (***Holotypus***); 07 Jun 1995; leg C. A. Inácio 294; UB (col. mycol.) 8610 (***Isotypus***).

Lesions up to 15 mm diam., amphigenous, circular or irregular, coalescing, dark brown, becoming necrotic with a pale grayish center (Figs 1, 2). *Primary mycelium* immersed, pale brown; hyphae light brown, septate, 2-4 μm diam. *Secondary mycelium* superficial, amphigenous, mainly hypophyllous; hyphae septate, pale brown, sometimes emerging through stomata,

often growing from stromatal cells and climbing leaf hairs; conidiophores formed as lateral branches (Figs 5, 6). *Stromata* 14-67 µm deep x 24-60 (-90) µm diam., subepidermal, erumpent, amphigenous, brown, *textura angularis*; cells 3-8 µm diam. (Fig. 3). *Conidiophores* 19-68 x 2-4 µm brown, 0-7 septate, straight to slightly curved, sometimes branched, sometimes geniculate, smooth, sympodial, caespitose, amphigenous; scars conspicuous (Figs 3, 6); often on secondary mycelium (Figs 5, 6). *Conidiogenous cells* smooth, polyblastic, integrated, proliferating sympodially, terminal or intercalary, with conspicuous scars. *Conidia* 14-85 x 2-5 µm, 0-4(-6) septate, non-constricted at septa, often catenate, light olive to pale brown, smooth, obclavate to subcylindrical, straight to slightly curved, base obconically truncate; scars conspicuous, darkened, thickened, refractive, often at both ends (Figs 4, 7, 8).

The genus *Mycovellosiella* is mainly characterized by the presence of superficial secondary hyphae laterally bearing conidiophores with cicatrized conidiogenous cells forming solitary or catenate conidia which possesses visible scars.

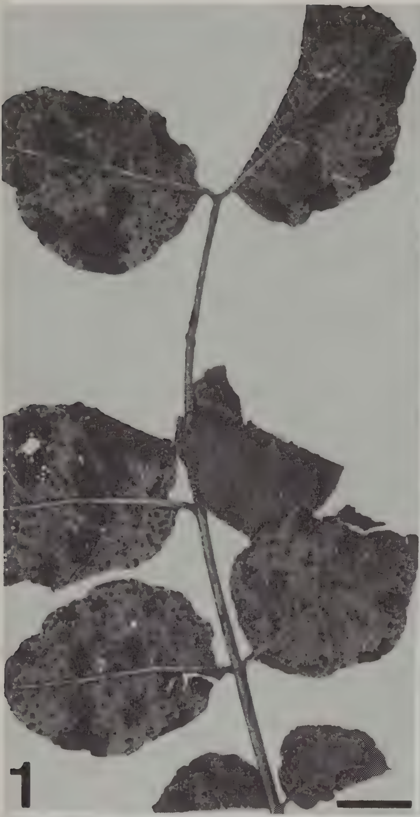
The related genus *Phaeoramularia* shows identical conidia that are always catenate, formed on conidiophores lining the surface of a stroma (Deighton, 1974, 1979; Braun, 1995, 1998).

Since *M. myracrodruonis* sp. nov. is stromatic and forms mostly catenate conidia on cicatrized holoblastic conidiogenous cells, it was compared to two *Phaeoramularia* species [*P. marmorata* (Tranz.) Deighton and *P. rhois* (E.

Castellani) Deighton] (Chupp, 1953; Ellis, 1976; Deighton, 1979), and a *Cercospora* species with catenate conidia, namely *C. phaeochlora* Speg. *emend.* Jenkins & Chupp, which were also reported on hosts belonging in the Anacardiaceae. However, none of three anacardiaceous fungi mentioned above form external secondary mycelium. Furthermore, these species also exhibit additional features which clearly separate them from the new *Mycovellosiella* species. Thus, as discussed by Chupp (1953), Deighton (1979), and Ellis (1976) the species *Phaeramularia marmorata* (Syn.: *Cercospora marmorata* Tranz., *Cercosporina marmorata* (Tranz.) Sacc., *Cladosporium rhois* C. Arcangeli, and *Cercospora rhois-couriariae* Kuhnholtz-Lodart) on *Rhus couriariae* L., *R. glutinosa* Hochs, and *R. villosa* L. have smaller stromata (up to 25 µm diam.); shorter (up to 40 µm), unbranched, less septate (0-1 septum) conidiophores; and less septate conidia (0-1 septum) when compared with *M. myracrodruonis* sp. nov.

The three exsiccates of *Phaeoramularia rhois* studied on *Rhus petitiana* A. Rich. and *R. villosa* by Deighton (1979) and on *Rhus* sp. by Ellis (1976)

Figs 1-4. *Mycovellosiella myracrodruonis* on *Myracrodruon urundeuva*, from the holotype. **Fig. 1.** Leaf symptoms with leaflets showing pinpoint lesions and large, dark, blighted areas. **Fig. 2.** A closer view of the symptoms on a leaflet. **Fig. 3.** A subepidermal stroma with *textura angularis* bearing a group of septate, cicatrized conidiophores. **Fig. 4.** Two catenulate conidia.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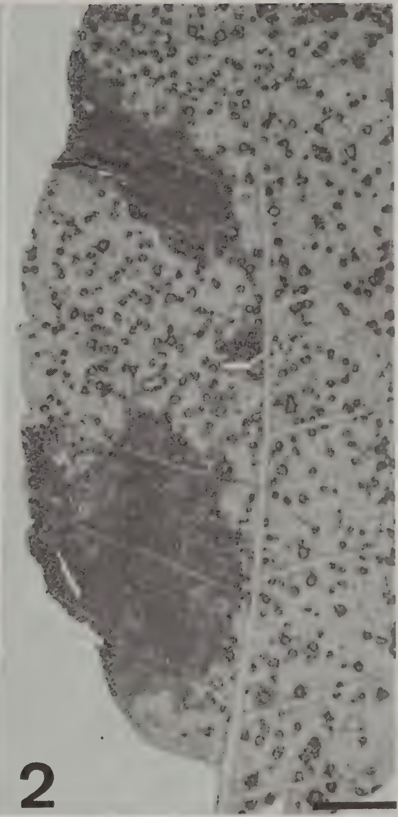
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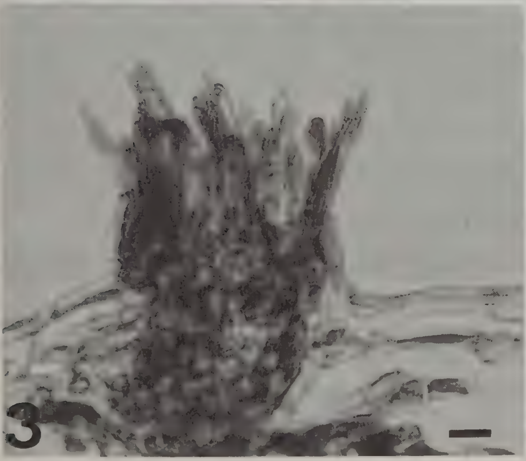
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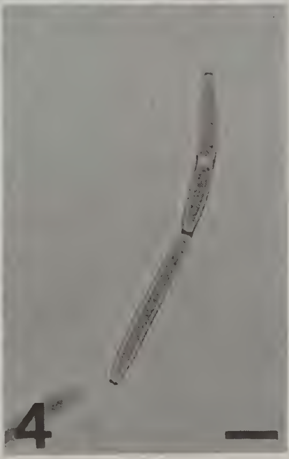
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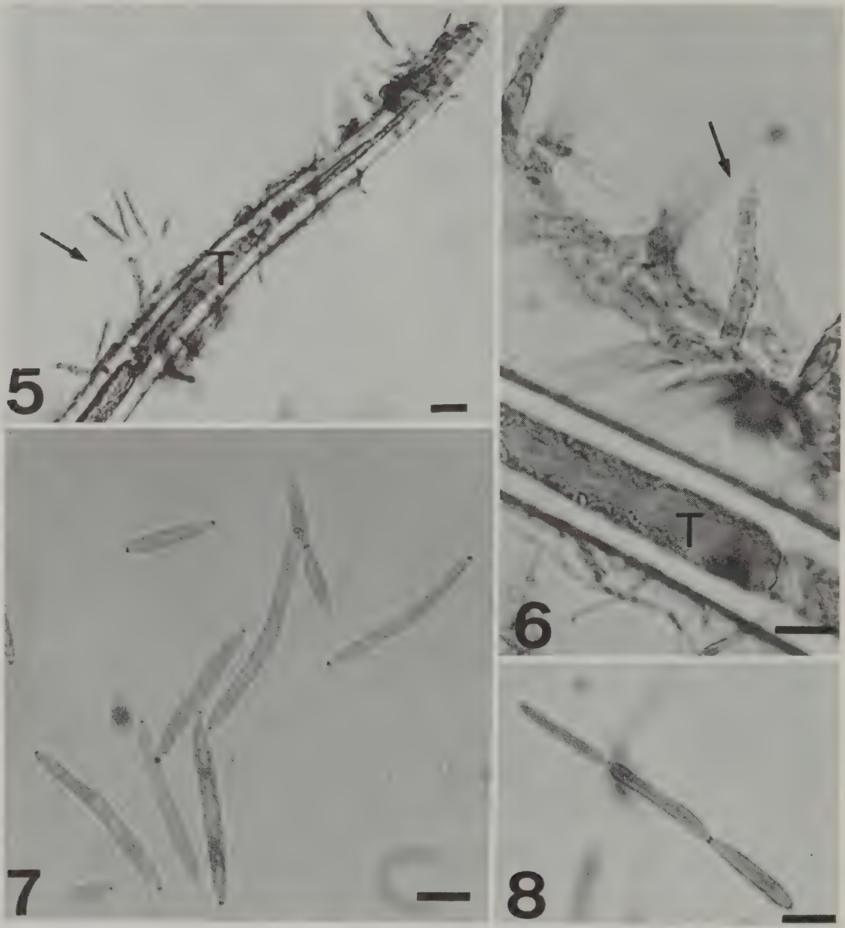

Figs 5-8. *Mycovellosiella myracrodruonis* on *Myracrodruon urundeuva*, from the holotype. **Figs 5, 6.** Secondary mycelium colonizing trichomes (T) forming lateral conidiophores (arrows). **Fig. 7.** Conidia with scars at both ends indicating a predominance of catenate spores. **Fig. 8.** Three conidia in chain.

differed among themselves in terms of conidial and conidiophore morphology but the differences were not sufficient to allow the establishment of two taxa.

Further differences between *P. rhois* and *M. myracrodruonis* sp. nov.include the inconspicuous or poorly developed stromata in the former, as well as the 0-1-septate unbranched conidiophores and longer (20-120 µm) more septate (0-7 septa) conidia.

Jenkins & Chupp (1941) and Chupp (1953) described and discussed *Cercospora phaeochlora* on *Lithraea brasiliensis* March. (Anacardiaceae), emphasizing that this *Cercospora* species sometimes formed catenate conidia, thus suggesting that it presently may be better accommodated in *Phaeoramularia*. However, *C. phaeochlora* showed smaller lesions (2-7 mm), larger conidia [20-90 (-150) x 3-5 µm] which were seldom catenate, less septated conidiophores (0-3 septa), and much smaller stromata than those observed in *M. myracrodruonis* sp. nov.

Finally, the new *Mycovellosiella* was compared to *Mycovellosiella rhois* (Sawada & Katsuki) Goh & Hsieh, the only *Mycovellosiella* species previously described on Anacardiaceae (Hsieh & Goh, 1990), specifically on *Rhus semialata* Murr. var. *roxburghiana* DC. *Mycovellosiella rhois* forms smaller leaf spots (2-7 mm wide) and stromata (up to 65 µm wide) than the new species. The stromata on *M. rhois* are epiphyllous and the secondary mycelium exclusively hypophyllous whereas in *M. myracrodruonis* both structures are amphigenous. Conidiophores on *M. rhois* are mainly formed on secondary mycelium. However, in the new species they are mostly caespitose and formed on the stromatal surface. Finally, the conidia of *M. rhois* have broadly obtuse, slightly cicatrized apices, while the conidia of the new species have subacute to obconically truncate apices, showing conspicuous basal and apical scars.

In conclusion, the data shown and discussed indicates that *M. myracrodruonis* is in reality a new *Mycovellosiella* species found on *M. urundeuva* native in the cerrado region of Central Brazil.

ACKNOWLEDGMENTS

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MYCOTAXON

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SOUTH AFRICAN FUNGI 9: PSILOCYBE NATALENSIS - A BLUEING HALLUCINOGENIC SPECIES FROM SOUTH AFRICA

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An account is given of the blueing, hallucinogenic *Psilocybe natalensis* which includes a description of the microcharacters based on an examination of the isotype; the microcharacters are illustrated. A more recent gathering from the same general geographical region is also fully described and illustrated for comparison.

Key words: *Psilocybe natalensis*, South Africa, blueing, hallucinogenic

Introduction

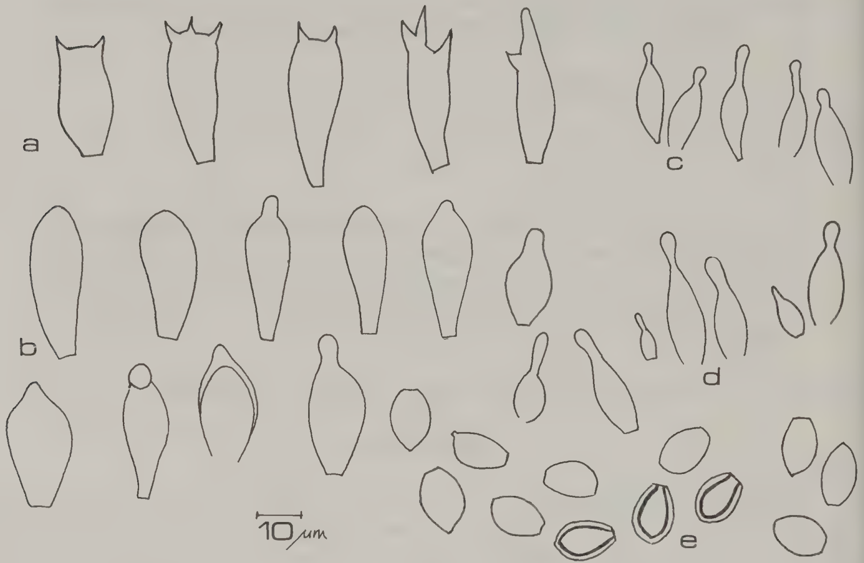
In January 1994 Jochen Gartz and Michael T. Smith discovered a large blueing *Psilocybe*, at O'Neils Cottage, KwaZulu-Natal; this locality is situated between Volksrust and Newcastle. The fungus was collected in cattle pasture recently fertilized with a mixture of ammonium nitrate and limestone, in full sunlight at temperatures of over 30 °C, at an altitude of 1500 m. However the fruitbodies were not growing directly on dung.

Subsequently the fungus was shown to represent a previously unknown species of *Psilocybe*, and it was described as *P. natalensis* Gartz, Reid, Smith & Eicker. However, publication of this new taxon was in the journal *Integration*, which is not always readily accessible to, or regularly scanned by mycologists with a taxonomic interest. As a result the species has been largely overlooked by mycologists, despite having both considerable interest and importance, by virtue of its hallucinogenic properties, and in having been shown to contain psilocybin, psilocin and baeocystin. However, it should be noted that *P. natalensis* was included by Stamets (1996) in his "Psilocybin Mushrooms of the World".

It was, therefore, decided to provide a slightly revised account of the original material based on observations of the fresh material by Gartz and Smith and on a microscopic study by one of us (DAR) of the isotype collection in PRUM. Illustrations of the microcharacters, omitted from the original publication, are also provided.

Since the initial gathering of *P. natalensis* by Gartz and Smith during January 1994, at O'Neils Cottage in the Drakensberg range we are able to report the finding of an additional collection at a new site, about 250 km from the original locality. This new site, also in the KwaZulu-Natal Drakensberg range, is at Hlalanathi Drakensberg Resort, Royal Natal National Park, Bergville District, 25 March 1998. The fruitbodies were again growing in an exposed situation, this time on a lawn exposed to full sunlight, but artificially irrigated.

A detailed account of this most recent gathering is also included.



Figs. 1 a-e. *Psilocybe natalensis*. a. Basidia, including abnormal bisporous and trisporous examples. b. Pleurocystidia - one showing apical thickening of the wall, another capped by a small droplet of mucilage. c. Cheilocystidia. d. Caulocystidia. e. Spores.
All from the Isotype in PREM. Bar = 10 µm.

Description of *Psilocybe natalensis* based on the original material from O'Neils Cottage. [Slightly modified from that of Gartz, Reid, Smith & Eicker (1995)].

Pileus 14 - 60 mm diam., obtusely conic to hemispheric, then convex to shallowly convex, sometimes with a small umbo, finally flattened with a spreading, non-striate margin, non-hygrophanous; when fresh, and also in the dried state, cream coloured, sometimes with a yellow-brown disc, or whitish, becoming pure white in older fruitbodies and then often showing discoloured blue-grey blotches or segments at the periphery, but not actually blueing on injury. Exsiccatum with a distinct sheen to the surface of the pileus, suggesting that the pileus might well have been viscid in damp conditions - this supposition is further supported by the microstructure of the pileipellis. **Lamellae** subdecurrent, at first buff, then dark purple-brown with a white edge. **Stipe** 40 - 120 mm high, 2 - 4 mm wide, narrowing toward the base or occasionally equal, dry, smooth, shining, white, lacking an annulus and without any velar traces, eventually hollow; on injury or when handled bruising blue-green, especially at the stem base after 5 to 10 minutes. **Smell** similar to that of other blueing species of *Psilocybe*. **Pileal surface** comprising a zone to 50 μm thick (or more?), of densely organized, more or less horizontal, 2.5 - 3.0 μm wide, hyaline, slightly thick-walled, slightly agglutinated, clamp-bearing hyphae. Beneath this zone are the hyphae of the context to 8.3 μm wide, with thin to distinct hyaline walls, and bearing clamp-connections at the septa. **Lamellar trama** regular. **Cheilocystidia** lageniform, 16 - 22 μm long, with an enlarged base 5.5 - 8.0 μm wide, and a short neck 3.5 - 6.0 μm in length, terminating in an obtuse, often slightly enlarged apex, hyaline, thin-walled, sometimes capped by a small droplet of mucilage. **Pleurocystidia** 18 - 40 x 10 - 15 μm, abundant or in some fruitbodies very rare, clavate or lanceolate with a mucronate, rostrate or papillate apex, sometimes ovate or obpyriform, hyaline, thin-walled or very rarely with slightly thick-walled apex, sometimes capped with a small droplet of mucilage. **Caulocystidia** at stem apex lageniform, similar to the cheilocystidia, 10 - 30 μm long, with enlarged base 4.0 - 8.5 μm wide, and short neck 2 - 5 μm in length terminating in a slightly inflated or subcapitate apex, 2 - 4 μm diam. **Basidia** 25 - 32 x 9 - 11 μm, clavate, hyaline, thin-walled, mostly 4-spored, some fruitbodies with a high proportion of abnormal monosporous, bisporous or trisporous basidia. **Spore print** deep violet or purple. **Spores** (10.0-) 12.0 - 14.0 x (7.0-) 8.5 - 9.5 μm, brown, broadly elliptic to ovoid, thick-walled, with truncate germ pore. **Habitat**: scattered in fertilized cattle pasture, but not on dung; the pasture having been treated with a mixture of ammonium nitrate and limestone two months previously. O'Neils Cottage, between Volksrust and Newcastle, KwaZulu-Natal, 1500 m alt., 22 January 1994, J. Gartz & T. Smith.

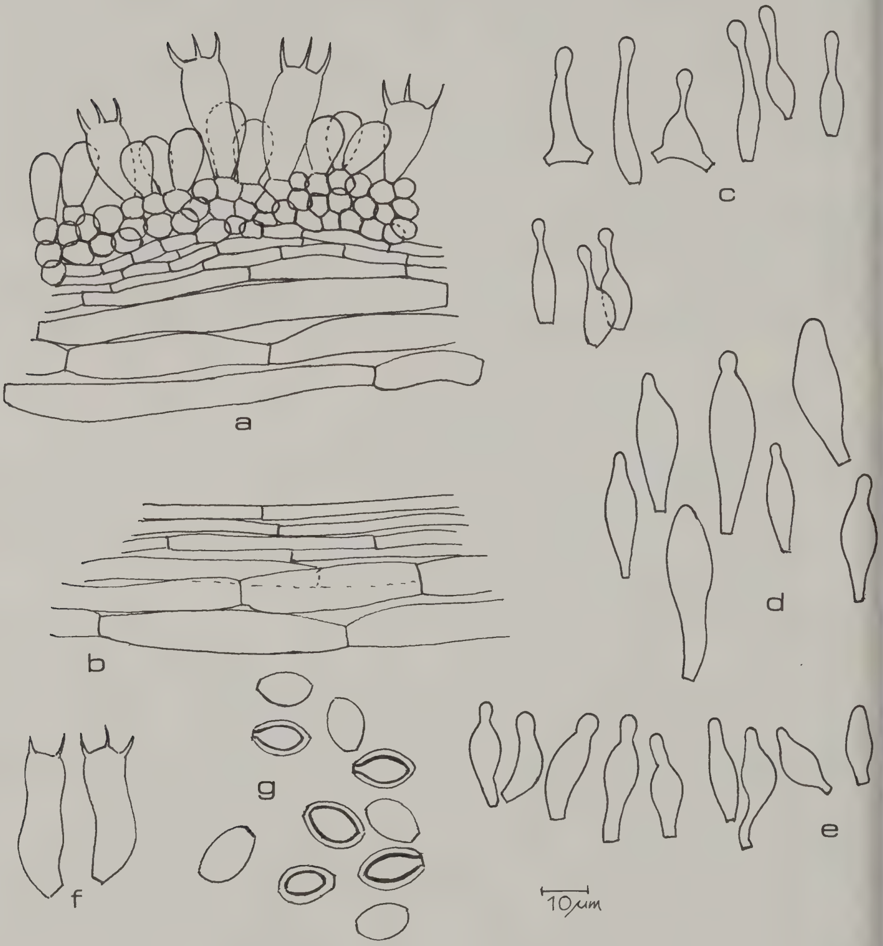
The distinctive features of *P. natalensis* are:

① The robust size of the fruitbodies, which may reach 60 mm diam.
② The blueing at the base of the stipe on handling after 5 - 10 minutes.
③ The pale cream coloured, non-hygrophanous pileus with a shiny surface in the dried condition, suggesting that the moist cap may be somewhat viscid. A suggestion enhanced by the structure of the pileipellis.
④ Presence of lanceolate or clavate pleurocystidia with a rostrate or papillate apex.
⑤ Large, rather broadly elliptic or ovate, thick-walled spores.
⑥ Presence of caulocystidia.
⑦ Occurrence in open pasture.

Using Guzmán's (1983) monograph of the genus *Psilocybe*, *P. natalensis* would appear to belong in the section *Cyanescens* but differs from other species in this section in its remarkable size, overall whitish colour and non-hygrophanous pileus. It comes close to the Australian species, *P. eucalypta* Guzmán & Watling. However, that species differs from *P. natalensis* in having a pileus which is "hygrophanous, red-brownish to brown or bright ochraceous, fading to dull fulvous or straw colour"; somewhat smaller, narrower spores (9.3-) 9.9 - 12.0(-13.0) x (6.0-)6.6 - 7.1 x 5.5 - 6.6 μm which are "subellipsoid both in face and side view"; and smaller, but very similarly shaped pleurocystidia.

Psilocybe cyanescens differs from *P. natalensis* in being less robust and in having both pileus and stipe bruising blue-green on handling. In contrast to the non-hygrophanous, non-striate, pale cream to whitish pileus of *P. natalensis* that of *P. cyanescens* is hygrophanous and strongly coloured when hydrated, ranging from fulvous to rusty tawny with striate margin, paling to buff or ochraceous only on drying. Further, whereas the stipe of *P. natalensis* is smooth, white and devoid of velar traces, that of *P. cyanescens* has a white silky-fibrillose surface, due to a thin cortinate veil. Another difference is that while *P. cyanescens* lacks pleurocystidia these organs are present, albeit sometimes sparsely so, in *P.*

natalensis. Again there is a spore difference between the two taxa; those of *P. cyanescens* being slightly smaller and somewhat lenticular "elliptic in side view, ovate in face view slightly flattened in side view" (Watling & Gregory, 1987). Finally, whereas *P. cyanescens* grows on herbaceous or woody debris, *P. natalensis* is found in open pasture or grassland.



Figs. 2 a-g. *Psilocybe natalensis*. a. Section through lamella showing basidia, parenchymatous subhymenium and lamella trama. b. Section through pileipellis. c. Caulocystidia fromstipe apex. d. Pleurocystidia. e. Cheilocystidia. f. Basidia showing median construction. g. Spores.
All from Hlalanathi Holiday Resort. Bar = 10 μm.

An account of a more recent collection of *P. natalensis*.

During a visit to the Hlalanathi Drakensberg Resort, Royal Natal National Park in March 1998, specimens of an ivory-white *Psilocybe* were collected, which, after a short interval of time, exhibited blue-green bruising at the base of the stem on handling. Since this locality is in the general area as that from which Gartz & Smith made their original collection of *P. natalensis*, and since both collections were made in exposed grassland, it was initially suspected, and later confirmed, that this recent find represented a second gathering of *P. natalensis*. A description follows:

Pileus to 25 mm diam., convex-campanulate, sticky, ivory-white with a slight ochraceous tint at the centre, non-hygrophanous, non-striate; edge of pileus slightly exceeding the lamellae and somewhat crenulate, at extreme margin slightly sulcate. **Lamellae** adnate to broadly adnate, or emarginate with a tooth, very broad, yellowish in very young specimens, becoming ochre-grey, and finally blackish-brown with a white edge at maturity. **Stipe** 30-50 mm long, 3 - 5 mm wide at the apex, tapering downward, whitish, developing blue-green tints at the base where handled or bruised, dry, sparsely flecked or scurfy at extreme apex, but neither striate nor fibrillose; without annulus or cortinate zone, except in very young specimens which may show a yellow arachnoid veil. In section the stipe is solid, appearing whitish in the cortex, and yellow-brown in the medulla. **Pileipellis** a cutis formed of a layer 30 μm thick or more, comprising narrow, thin-walled, hyaline, radially repent, parallel hyphae, 2 - 3 μm diam., densely compacted and agglutinated. **Pileal context** of thin-walled, hyaline, interwoven hyphae to 16 μm diam., with clamp-connections at the constricted septa (but often difficult to demonstrate); oleiferous hyphae are also present, 3.0 - 6.6 μm wide, as very long vermiform, branched elements, with subhyaline refractive contents. **Stipe context** of vertical, parallel, thin-walled hyphae, 3 - 12 μm wide, with clamp-connections at the septa. **Lamellar trama** regular, comprising a central stratum, flanked on either side by a parenchymatous subhymenium formed of thin-walled, rounded cells, 4 - 7 μm diam. **Cheilocystidia** 16.0 - 27.0 x 5.0 - 8.0(-9.5) μm, thin-walled, hyaline, varying from lageniform with an inflated base, 5 - 7 μm wide, prolonged above into a short obtuse neck, or lanceolate with a rostrate apex, up to 6 μm long, which may be almost subcapitate. **Pleurocystidia** from abundant to seemingly absent, intergrading with the cheilocystidia; others resembling chrysocystidia in shape and size, measuring 25.0 - 37.0 x 6.0 - 10.5 μm, thin-walled, hyaline, varying from fusoid to lanceolate with a short rostrate apex, not staining in cotton blue, or only weakly so. **Caulocystidia** present at the apex of the stipe and resembling the cheilocystidia; these organs often develop from a bifurcate base. They are thin-walled, 18 - 30 μm long, with a swollen ventricose base, 4 - 7(8) μm wide, prolonged above into a narrow neck up to 10(-15) μm long, and 1.0 - 1.5(-3.0) μm wide, terminating in an enlarged, often subcapitate apex, 2.0 - 3.5 μm diam. **Basidia** 27.0 -31.0 x 9.5 - 10.5 μm, thin-walled, hyaline, clavate, 4-spored, sometimes with a slight median constriction. **Spores** (11.0-)11.2 - 14.0(-15.0) x 7.5 - 8.5(-9.5) μm, ellipsoid or broadly ellipsoid to ovoid with a conspicuous germ-pore, and thick brown wall. The wall comprises a pale outer layer and an inner brown layer. **Habitat**: On an irrigated lawn, Hlalanathi Drakensberg Resort, Royal Natal National Park, Bergville District, 25 March 1998, PRUM 3920.

The collection from Hlalanathi, described above, matches the account of the original material from O'Neils cottage extremely closely, and there can be no doubt that the two gatherings are conspecific.

The finding of this second gathering of *P. natalensis* is very satisfactory, as although the new locality is in the same general area of KwaZulu-Natal, as that from which the original material was found, it extends its known distribution by about 250 km in a south westerly direction as the 'crow flies'. It is only by the accumulation, and publication, of such additional records of the species, that a true picture of its distribution in South Africa will become clear.

Acknowledgements

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MYCOTAXON

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LICHEN FLORA OF EASTERN NORTH AMERICA: THE GENERA PARMELIOPSIS AND IMSHAUGIA

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ABSTRACT: The genera *Parmeliopsis* and *Imshaugia* are reviewed for eastern North America, and descriptions, keys, distribution maps, and illustrations are provided for the 6 species recognized: *P. ambigua, capitata, hyperopta, subambigua, I. aleurites,* and *I. placorodia*. The recently minimally validated species, *P. capitata* R. C. Harris, is provided with a complete description and is found to differ from *P. ambigua* in its much higher frequency of capitate soralia, as well as 10 other characters, including its generally lighter colored lower surface, narrower, more ascending and more divergent lobes, smaller size of thalli which possess soralia, and less northerly geographical distribution. *P. hyperopta*, in addition to its well known color difference from *P. ambigua* and *capitata,* appears also to differ from them in its broader geographical distribution, soralia commonly both laminal and terminal, and its generally longer spores. *P. subambigua* differs from the other three species in *Parmeliopsis* in its non-overlapping geographical distribution and its diffuse, pustulate soralia. The geographical distribution of the two very distinctive species of *Imshaugia* are both found to be broader than previously reported.

This review of the lichen genera *Parmeliopsis* and *Imshaugia* in eastern North America (eNA) is another in a series by various authors planned to cover all the lichens of eNA (south of 54° N and east of 97° W). The two genera are being treated together because until recently they were considered a single genus (*Parmeliopsis*).

In the present study, distribution maps are based on specimens examined by the author and others (see Acknowledgments) as well as literature reports considered by the author to be reliable. A detailed list of every accepted specimen and literature report may be obtained from the author upon request. Herbaria have been abbreviated following Holmgren et al. (1990), except for the following private herbaria: CLAYDEN, CIEGLER, LADD, and HINDS. Distribution maps have been generated using decimal latitudes and longitudes and MapInfo Desktop software. Lobe widths have been measured at the narrowest parts of the lobe; spores of *P. capitata* have been measured in 10% KOH. References singled out as "Key References" below are not usually specifically cited in the text, even though they were often relied upon for chemistry and for spore, conidial, and anatomical measurements.

KEY TO N.A. SPECIES OF PARMELIOPSIS AND IMSHAUGIA

1. Thallus sorediate (*Parmeliopsis*)
   2. Thallus whitish gray to gray, upper cortex K+ yellow.............. **P. hyperopta**
   2. Thallus greenish or grayish yellow; upper cortex K-
      3. Soralia arising from pustules, diffuse, and laminal; found only in coastal plain from SE Massachusetts southwards..**P. subambigua**
      3. Soralia not pustular, usually well demarcated, laminal or apical; found in boreal or boreal/temperate transitional regions, never in coastal plain
         4. Soralia mostly apical at ends of upturned narrow lobes (capitate), lower surface usually light brown to brown, not becoming gradually darker towards center; boreal to boreal/temperate transitional regions....... ....**P. capitata**
         4. Soralia mostly laminal on appressed lobes, lower surface usually showing gradual darkening from brown at margin to dark brown or black towards center; strictly boreal ....**P. ambigua**
1. Thallus without soredia (*Imshaugia*)
   5. Isidiate; apothecia uncommon ....**I. aleurites**
   5. Not isidiate; apothecia common ....**I. placorodia**

PARMELIOPSIS (Nyl.) Nyl., Not. Sällsk. Fauna Fl. Fenn. Förh. 8:121 [preprint] (1866); *Parmelia* subg. *Parmeliopsis* Nyl., Not. Sällsk. Fl. Fenn. Förh. 5: 130 (1861). Common name (McCune & Geiser 1997): starburst lichen. Etymology (Feige 1996): *Parmelia* + Greek *opsis*, appearance.

SYNONYM: *Foraminella* S. F. Meyer, Mycologia 74: 596 (1982).

TYPE SPECIES (Jørgensen 1988, Gams 1993): *Parmelia ambigua* (Wulfen) Ach. (*Lichen ambiguus* Wulfen, *Parmeliopsis ambigua* (Wulfen) Nyl.), *typ. cons.*

KEY REFERENCES: Ahti & Isoviita 1987; Hale 1967; Hawksworth 1985; Meyer 1979, 1982; Riddle 1917.

SELECTED PREVIOUS ILLUSTRATIONS: Color photos: McCune & Geiser 1997 (*ambigua, hyperopta*), Wirth 1995 (*ambigua, hyperopta*); B & W photos: Hale 1967, 1979 (*capitata* [labeled as *ambigua*], *subambigua*).

HISTORY OF GENUS: *Parmeliopsis* has had a remarkably contentious history. Nylander coined the epithet *Parmeliopsis* in a 1861 publication, apparently intending it as a subgenus of *Parmelia*; he included in it three species: *ambigua, aleurites,* and *placorodia.* Later (1866) Nylander raised *Parmeliopsis* to the level of a genus. Clements & Shear (1931) selected *P. ambigua* as the type of the genus, perhaps because only *P. ambigua,* of the three species cited by Nylander in 1861, was not in conflict with Nylander's protologue. Hawksworth (1985) and Hawksworth & David (1989), however, made the interpretation that Nylander (1861) had typified *Parmeliopsis* with *P. placorodia*. Ahti & Isoviita (1987) did not accept that interpretation and argued for conservation of *P. ambigua* as the type. To settle this dispute Jørgensen (1988) proposed that in the interest of nomenclatural stability, the type of the genus should be *P. ambigua*. In 1993 the Committee for Fungi and Lichens ruled in favor of the type being *P. ambigua* (Gams 1993).

According to Ahti & Isoviita (1987), it was recognized early by Fries (1871) that the genus *Parmeliopsis* of Nylander was heterogeneous; Fries realized that the conidia of *P. aleurites* were quite unlike those of *P. ambigua,* and transferred *aleurites* into *Cetraria* (where Tuckerman [1847] had already included *placorodia*) and included *ambigua* in *Parmelia*. Vainio (1881) amended *Parmeliopsis* so that *ambigua* and *hyperopta* were left in *Parmeliopsis,* while *placorodia* and *aleurites* were included in *Platysma.* Nevertheless, during most of the 20th century, *Parmeliopsis* was considered to include all four of the above-cited species; it was distinguished from *Parmelia* by the conidia being borne terminally (exobasidial) instead of laterally (endobasidial). Some 20th century authors, however, recognized sections within *Parmeliopsis*, e.g. Hillmann (1936), who recognized two sections based on conidial shape. The first to demonstrate clearly that *Parmeliopsis* s.l. needed to be broken up into two genera was Meyer (1982). She showed that there were two groups in *Parmeliopsis* s.l., one with immersed laminal pycnidia, falcate conidia lacking swellings, reniform to allantoid ascospores, and divaricatic acid, while the other group had emergent, laminal to marginal pycnidia, short, bacilliform conidia with one (or two) subapical swellings, ellipsoid ascospores, and thamnolic acid. Based on her interpretation that the type species of *Parmeliopsis* was *P. placorodia*, she named the former group *Foraminella* and the latter remained as *Parmeliopsis.* In 1985, however, she decided that, based on Clements and Shear's (1931) lectotypification of *P. ambigua* as the type species for *Parmeliopsis*, the names of the two segregate genera in *Parmeliopsis* s.l. needed to be revised so that the group with falcate conidia (which included *P. ambigua*) would be retained in *Parmeliopsis*, and the group with bacilliform conidia was given the new name of *Imshaugia*, named after the North American lichenologist, H. A. Imshaug. After considerable debate (cited above) the Committee for Fungi and Lichens ruled in 1993 (Gams 1993) in effect that Meyer's (1985) names for the two genera should stand.

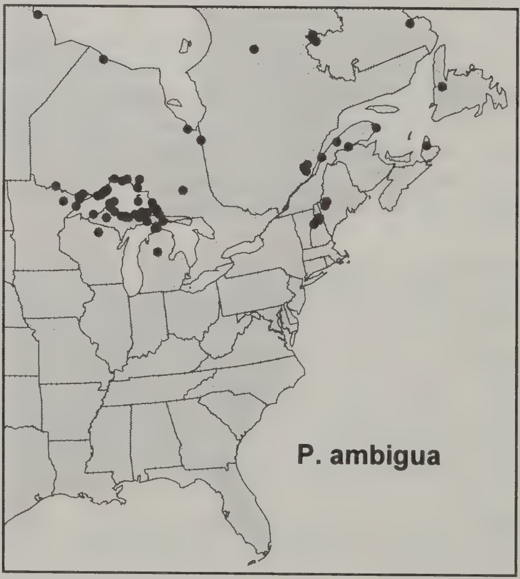
VEGETATIVE STRUCTURES: Thallus foliose, rosette forming, up to 6 (10) cm broad, with radiating, strap-shaped lobes divaricate, contiguous, or overlapping, 0.2-1.0 mm wide. Upper surface greenish to grayish yellow or whitish gray to gray, generally matte in center and shiny at lobe margins, with laminal or terminal soralia. Lower surface whitish to light brown to dark brown or black with simple rhizines. Upper cortex paraplectenchymatous with pored epicortex, 10-20 μm thick, algal layer and medulla 60-150 μm thick, and lower cortex paraplectenchymatous, 5-20 μm thick. Phycobiont green, *Trebouxia.*

REPRODUCTIVE STRUCTURES: Apothecia laminal, sessile to short-stipitate, up to 5 mm in diameter, with margins concolorous with thallus and disks mostly light brown, sometimes reddish to dark brown. Epihymenium brownish, 5-10 µm thick; hymenium hyaline, 30-50 µm thick; paraphyses simple; subhymenium and exciple hyaline. Spores slightly curved to kidney-shaped, hyaline, single-celled, eight per ascus, 6-12 (15) X 2-4 (6) µm. Pycnidia black, laminal and immersed; conidia falcate, 15-18 (30) X 0.5-1.5 µm.

CHEMISTRY: cortex with usnic acid and/or atranorin; medulla with divaricatic acid.

DISTRIBUTION AND SUBSTRATES: *Parmeliopsis* species are generally corticolous or lignicolous (rarely saxicolous) with their distribution in eNA generally matching the distribution of conifers, being common in boreal, transitional boreal/temperate, and southeast coastal plain regions where conifers are common, but absent in temperate regions dominated by hardwood trees. Eastern NA has two species widespread in the boreal northern hemisphere (*ambigua* and *hyperopta*) and two endemic species (*capitata* and *subambigua*).

Parmeliopsis ambigua (Wulfen) Nyl., Not. Sällsk. Fauna Fl. Fenn. Förh. 8: 121 [preprint] (1866); *Lichen ambiguus* Wulfen *in* Jacquin, Collect. Bot. 4: 239 (1790). **Type**: type specimen of Wulfen has not survived, but the species is illustrated in Plate 4, Figure 2 (p. 239); Meyer (1979) chose not to designate this illustration as a type, however. **Syn**: *Squamaria ambigua* (Wulfen) Hoffm., Descript. Adumbrat. Pl. Lich. 2: 56 (1794). *Parmelia ambigua* (Wulfen) Ach., Methodus: 207 (1803). *Foraminella ambigua* (Wulfen) S. F. Meyer, Mycologia 74: 597 (1982). *Parmelia ambigua* var. *diffusa* Schaerer, Enum. Crit. Lich. Eur.: 47 1850. *Parmelia diffusa* Th. Fr., Lich. Arct.: 60 (1860) [not *Lichen diffusus* Weber].



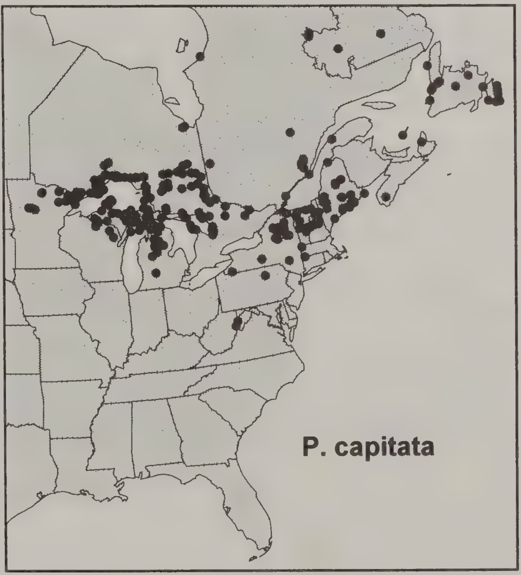
MORPHOLOGY: Thallus adnate on trees, especially conifers, or lignum (rarely rocks), greenish yellow to yellow (often brownish at lobe tips), up to 6 (10) cm broad, with usually contiguous or overlapping adnate lobes 0.3-1.0 mm wide, commonly showing rhizines extending beyond lobe edges. Upper surface weakly maculate, with well-delimited, roughly circular, flat or convex, granular soralia that are usually laminal, occasionally terminal, sometimes forming a continuous sorediate crust in older central parts; lower surface usually showing gradual darkening from brownish at margins to dark brown to black towards center, occasionally uniform light brown to brown. Apothecia and pycnidia uncommon; spores (6.5-13.0) 9.5 X 3.5 (1.5-5.0) µm.

CHEMISTRY: divaricatic acid (medulla UV+ white) and usnic acid (cortex KC+ yellow).

DISTRIBUTION (map based on 95 sites: FH, H, HINDS, MICH, MSC, NY, UMBS, US, Meyer 1979): a circumpolar species that in eNA is common in boreal Canada, but reaches the U.S. only in northern Michigan, Minnesota, Wisconsin, and the mountains of northern New England. Widespread in western U.S., Europe, northern Asia, and Australia

REMARKS: Fertile specimens of *P. ambigua* in eNA are disproportionately often found on lignum compared with other substrates: 10 of 15 fertile specimens are on lignum, while only 26 of 116 sterile specimens are on this substrate (chi-square test, $P < 0.001$). In eNA *P. ambigua* needs to be carefully distinguished from *P. capitata*, a recently reported (Hinds & Hinds 1998) segregate species from *P. ambigua* s.l., and one that is much more common and widely distributed in southern Canada and northern U.S. See the Remarks section of *P. capitata* for a discussion of the differences between the two species and the reasons for separating *P. capitata* from *P. ambigua.*

Parmeliopsis capitata R. C. Harris in Hinds & Hinds, *in* Glenn, M. G. et al., *Lichenographia Thomsoniana*: 357 (1998). **Type**: USA, West Virginia, Pendleton Co., top of Spruce Knob (*Hale, Lich. Amer. exs. 68*: NY, holotype; MICH, isotype). **Syn**: *Parmeliopsis ambigua* var. *capitata* R. C. Harris *ex* S. F. Meyer, *nom. inval*. (Meyer 1979).



MORPHOLOGY: Thallus adnate on trees, especially conifers, or lignum (very rarely rocks), often on small branches and twigs as small as 2 mm wide, grayish or dingy greenish yellow, from very small (0.05-0.1 cm up to 4 (6) cm broad, with usually divaricate, ascending lobes, 0.2-0.7 mm wide. Upper surface weakly maculate, with well delimited, greenish yellow, granular soralia mostly terminal and orbicular on ascending lobes (capitate), occasionally convex and laminal; lower surface usually uniformly light brown to brown, occasionally whitish or dark brown to black. Apothecia and pycnidia uncommon; spores (6.0-12.5) 8.25 X 3.25 (2.5-4.0) µm.

CHEMISTRY: divaricatic acid (medulla UV+ white) and usnic acid (cortex KC+ yellow).

DISTRIBUTION: (map based on 284 sites: FH, H, HINDS, NY, MAINE, MICH, MSC, UMBS, US, Meyer 1979): common in southern boreal and transitional forests of southern Canada and northern United States from longitude 95° eastward; found sparingly south to mountains of West Virginia and north to latitude 55° east of Hudson Bay.

REMARKS: *P. capitata* differs from *P. ambigua* s.str. in a number of characters that collectively justify its status as a separate species. A histogram based on *P. ambigua* s.l. specimens (N=53), showing on the ordinate the percentage of soralia that are capitate out of the total that are clearly capitate or laminal, reveals a distinctly bimodal distribution with no overlap, with one population (N=30) 38-100% capitate (mean = 83.7%) and one population (N=23) 0-5% capitate (mean = 0.8%). Using these two populations as a tentative demarcation between *P. capitata* and *P. ambigua*, a number of other characters were found also to differ, thus strongly supporting the delimitation as two separate species. The Table on the following page summarizes the differences found between the two species. For those differences that have been quantified, the arithmetic mean is shown in parentheses and the results of statistical analysis shown at the bottom of the Table.

Although the characters cited in the Table generally are all found together as described, occasionally there are discordant elements, for example a specimen with a *capitata* morphology above but black lower surface or an *ambigua* morphology above and uniformly light brown to brown on the lower surface. Since these rare discordant specimens all have been found in areas studied where the two species overlap in distribution, it may be that there is some hybridization at these sites. However, even in cases where both species occur commonly together (e.g., Parc des Grands-Jardin in Quebec, Canada), most specimens fall clearly into one species or the other.

Several yellow-green *Parmeliopsis* specimens have been collected by T. Ahti from Northwest Territories, Canada at about 62° N, near a glacial era refugium. These specimens all have soralia comparable to *P. capitata*, but differ from *P. capitata* in showing a black underside, dark projecting rhizines, and an upper surface color like *P. ambigua* (R. C. Harris, personal communication). The taxonomic status and evolutionary implications of this population remain a subject for further study.

TABLE 1 - SUMMARY OF DIFFERENCES OF P. CAPITATA & AMBIGUA

Character	P. capitata	P. ambigua
% Capitate Soralia[1]	38.3-100.0% (83.7%)	0-5.3% (0.8%)
Lobe Adhesion	ends usually ascending	usually closely appressed
Lobe Arrangement[2]	mostly divaricate (67%)	mostly contiguous (80%)
Narrowest Lobe Width (average of 10 measurements per specimen)[3]	0.34-0.51 mm (0.39 mm)	0.45-0.61 mm (0.51 mm)
Size of Smallest Thallus with Soralia/Specimen[4]	0.5-2.7 mm (1.0 mm)	0.6-10.0 mm (5.0 mm)
Usual Color of Upper Surface of Thallus	grayish to dingy greenish yellow	greenish yellow to yellow
Color of Lobe Margins	rarely brown	often brown
Color of Lower Surface[5]	usually uniformly light brown to brown (86.7%)	usually brown at margins changing to dark brown or black centrally (87.0%)
Rhizines Projecting Beyond Lobe Margins	rarely	commonly
Frequency on Twigs & Small Branches[6]	29.1%	10.5%
Geographical Distribution in eNA	temperate/boreal transitional region to mid-boreal	mid-boreal to arctic (also in western US and Europe

[1] Mann-Whitney Test, $P<0.0001$; $N=53$

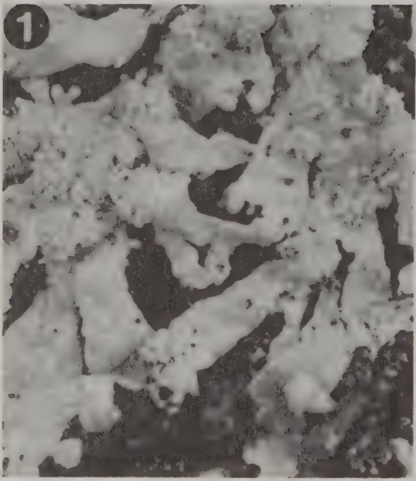
[2] Chi-square Test, $P=0.0001$; $N=54$

[3] Student's T Test, $P<0.0001$; $N=22$

[4] Student's T Test, $P=0.001$; $N=20$

[5] Chi-square Test, $P<0.0001$; $N=53$ (central lobes dark brown to black vs. light brown to brown)

[6] Chi-square Test, $P=0.01$; $N=124$ (based on R. C. Harris data)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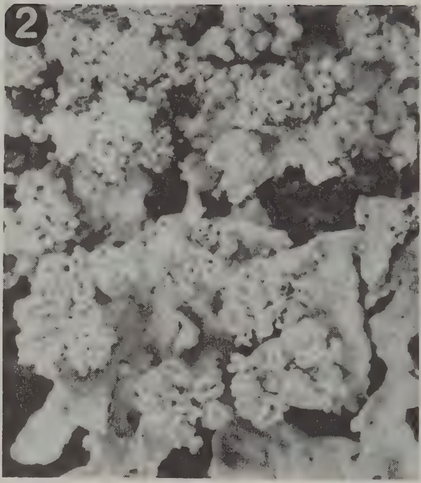
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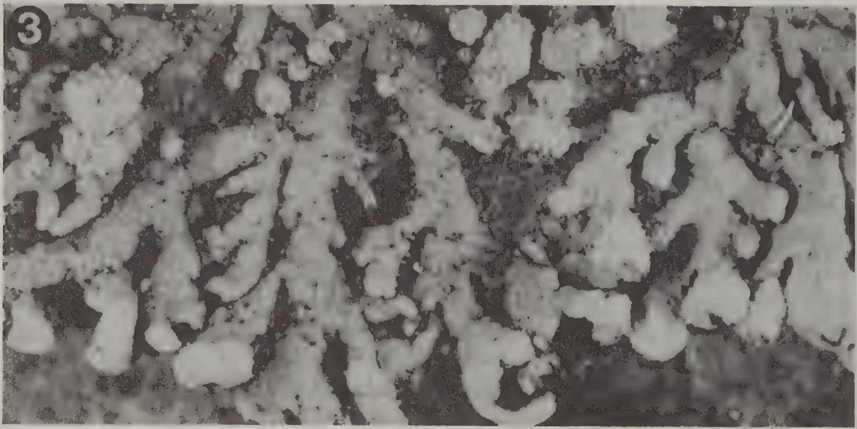
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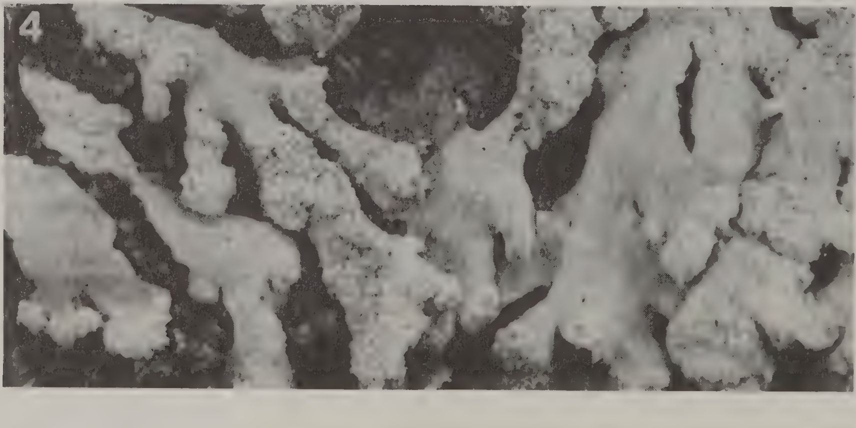
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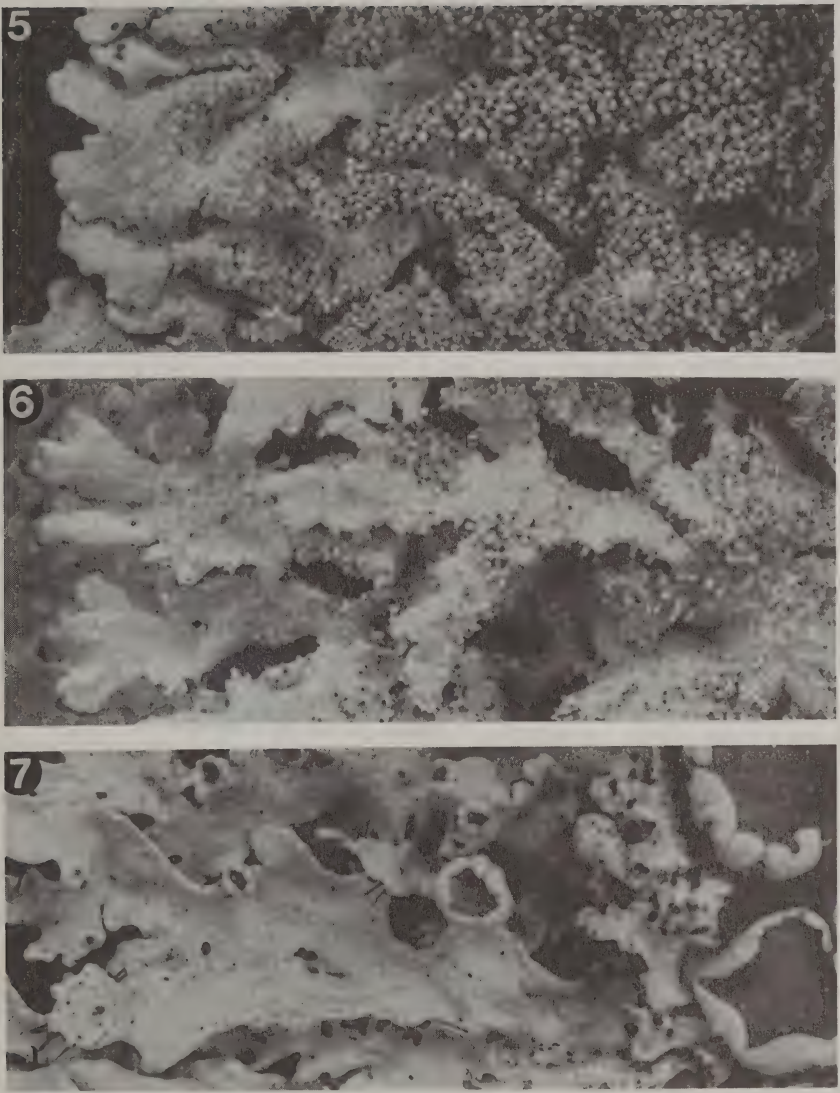


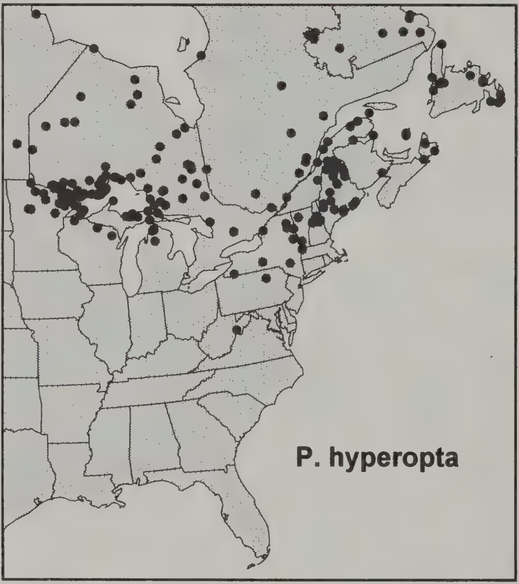
Figures 1-7. Species of *Parmeliopsis* and *Imshaugia*. **1.** *P. ambigua* (Quebec, *Hinds 3929*, HINDS): soralia all laminal. X13. **2.** *P. subambigua* (South Carolina, *Ciegler 6509*, CIEGLER): soralia all laminal, arising from pustules (upper right). X13. **3.** *P. capitata* (Maine, *Hinds 947*, HINDS): soralia all at ends of ascending lobes (capitate). X13. **4.** *P. hyperopta* (Maine, *Hinds 2154*, HINDS): soralia both at ends of lobes (e.g. lower left) and laminal. X13. **5.** *I. aleurites* (Maine, *Hinds 2502*, HINDS): tightly packed isidia centrally, lobes contiguous. X13. **6.** *I. aleurites* (Maine, *Hinds 2239*, HINDS): isidia more dispersed, lobes not contiguous. X13. **7.** *I. placorodia* (Maine, *Hinds 2679b*, HINDS): no isidia or soredia but apothecia and emergent black pycnidia (e.g., left of large apothecia and lower edge of central lobe) common. X10.

Parmeliopsis hyperopta (Ach.) Arnold, Verh. Zool. Bot. Gesell. Wien 30: 117 (1880); *Parmelia hyperopta* Ach., Syn. Meth. Lich.: 208 (1814). **Type** (Meyer 1979): Switzerland, on bark of tree trunk (H-ACH 1317, lectotype). **Syn**: *Foraminella hyperopta* (Ach.) S. F. Meyer, Mycologia 74: 597 (1982). *Parmeliopsis diffusa* (Weber) Riddle, Bryologist 20: 75 (1917); *Lichen diffusus* Weber, Sp. Fl. Goett.: 250 (1778), *nom. rej. prop.* *Parmelia ambigua* var. *albescens* (Wahlenb.) Schaerer, Enum. Crit. Lich. Europ.: 47 (1850); *Lichen ambiguus* var. *albescens* Wahlenb., Flora Suec., Vol. II: 818 (1826).

MORPHOLOGY: Thallus adnate on trees, especially conifers, and lignum (rarely rocks), light (to dark) gray (brownish at lobe tips), up to 7 (8) cm broad, with usually contiguous to overlapping lobes, 0.3-1.0 mm wide. Upper surface with well delimited, whitish, granular soralia that are either terminal on adnate or somewhat ascending lobes or laminal; lower surface light to dark brown. Apothecia and pycnidia uncommon; spores (8.0-15.0) 11.0 X 3.0 (1.5-5.0) µm..

CHEMISTRY: divaricatic acid (medulla UV+ white) and atranorin (cortex K+ yellow).

DISTRIBUTION (map based on 283 sites: FH, H, HINDS, LADD, NY, MAINE, US, Ahti 1964, Clayden & Bouchard 1983, Gowan & Brodo 1988, Lamb 1954, Meyer 1979, Rao & Leblanc 1967, Reilly 1972, Selva 1988, 1989, Sirois et al. 1988, Thomson 1984, Wong & Brodo 1992, Yarranton 1972): a circumpolar species that in eNA is found in boreal and transitional forests of Canada and northern US, south to mountains of West Virginia; also widespread in western NA, Europe, northern Asia, and South America.



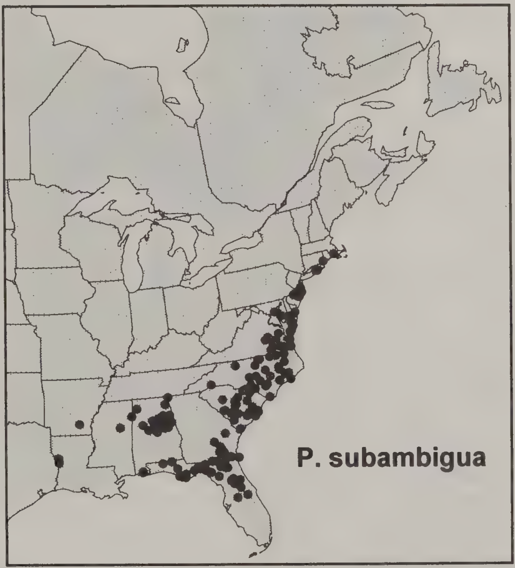
REMARKS: Although *P. hyperopta* has been said to differ from *P. ambigua* only in its color and chemistry, it appears to differ morphologically in the placement of its soralia, which are more often terminal (capitate) in *P. hyperopta* than in *P. ambigua*. *P. hyperopta* resembles *P. ambigua* in its lobe arrangement and lobe width and differs from *P. capitata* in these characters; its lobes also are more adnate than in *P. capitata* and fewer of them have capitate soralia. The lower surface of *P. hyperopta* varies from light brown to dark brown, thus encompassing the usual range of color of *P. ambigua* and *P. capitata* collectively. Likewise its distribution is similar to that of the combined distribution of both *P. ambigua* and *P. capitata*. Its spores, however, average longer than either *P. ambigua* or *P. capitata*.

Parmeliopsis subambigua Gyelnik, Ann. Mycol. 30: 457 & 459 (1932). **Type** (Meyer 1979): Maryland, Anne Arundel Co., Bent Oak, on *Pinus rigida*, C. C. Plitt (BP, holotype). **Syn**: *Foraminella subambigua* (Gyelnik) S. F. Meyer, Mycologia 74: 598 (1982). *Parmeliopsis halei* (Tuck.) Hale, Bryologist 70: 421 & 422 (1967); *Parmeliopsis ambigua* var. *halei* (Tuck.) Zahlbr., Cat. Lich. Univ. 6: 13 (1929); *Parmelia ambigua* c. *halei* Tuck., Syn. N. Am. Lich. I: 66 (1882).

MORPHOLOGY: Thallus adnate on trees, especially conifers, or lignum, greenish yellow, often shiny, up to 6 cm broad, with adnate, divaricate to contiguous lobes 0.3-0.8 mm wide. Upper surface with diffusely distributed, laminal, pustular, coarsely granular, greenish yellow soralia; lower surface whitish to cream-colored to light brown. Apothecia and pycnidia uncommon, spores (8.0-13.0) 10.5 X 4.0 (3.5-6.0) µm.

CHEMISTRY: divaricatic acid (medulla UV+ white) and usnic acid (cortex KC+ yellow).

DISTRIBUTION (map based on 163 sites: CIEGLER, FH, H, MIN, HINDS, NY, US, Dix 1961, Hale 1967, McCullough 1964, 1967, Metzler 1980, Meyer 1979, Moore 1968): common in pine forests and cypress swamps of the coastal plain from Florida to New Jersey and less commonly west to Louisiana and northeast to SE Massachusetts; also found occasionally in the piedmont region of Alabama and North Carolina and overlapping there with the distribution of *Imshaugia aleurites*.



REMARKS: *P. subambigua* differs from *P. capitata* by the laminal position of its soralia, from *P. ambigua* by its less well delimited soralia and the lighter color of the lower surface, from *P. hyperopta* by the greenish yellow color of its upper surface, and from all species by its pustulate, more coarsely granular soralia. *P. subambigua* also does not overlap in its distribution with any of the other three species in the genus; in the northeast extension of its distribution to New York and SE Massachusetts, it is strictly coastal, where none of the other three species has ever been reported.

IMSHAUGIA S. F. Meyer, Mycologia 77: 337 (1985). Common name (I. Brodo, personal communication): starburst lichen. Etymology: named for the North American lichenologist, H. A. Imshaug.

SYNONYM: *Parmeliopsis,* sensu Meyer 1982.

KEY REFERENCES: Culberson 1956; Meyer 1979, 1982, 1985; Riddle 1917.

SELECTED PREVIOUS ILLUSTRATIONS Color photo: Wirth 1995 (*aleurites*); B & W photos: Dobson 1992 (*aleurites*), Hale 1979 (*aleurites*), Taylor 1967 (*aleurites, placorodia*); Drawings: Hale 1979 (*placorodia*), Thomson 1984 (*aleurites*).

HISTORY OF GENUS: See *Parmeliopsis.*

VEGETATIVE STRUCTURES Thallus foliose, rosette-forming, up to 8 (12) cm broad, with radiating, strap-shaped or rounded lobes divergent, contiguous or overlapping, 0.5-1.5 mm wide. Upper surface mineral gray, matte in center and shiny at lobe margins, with laminal isidia or not. Lower surface whitish to light brown with sparse, simple rhizines. Upper cortex paraplectenchymatous with pored epicortex, 10-20 µm thick, algal layer and medulla 75-220 µm thick, and lower cortex paraplectenchymatous, 10-20 µm thick. Phycobiont green, *Trebouxia* in *I. aleurites* and *Myrmecia* in *I. placorodia*).

REPRODUCTIVE STRUCTURES: Apothecia laminal, sessile to short-stipitate, up to 12 mm in diameter, with margins concolorous with thallus and disks mostly light brown, sometimes dark brown. Anatomy of the apothecia similar to *Parmeliopsis.* Spores ellipsoid, hyaline, single-celled, eight per ascus, 5.0-9.0 X 3.5-6.0 µm. Pycnidia black, emergent, laminal to marginal, up to 0.2 mm wide; conidia dumbbell-shaped to bowling pin-shaped, 3.0-6.0 X 0.5-1.5 µm.

CHEMISTRY: thallus with thamnolic acid and atranorin.

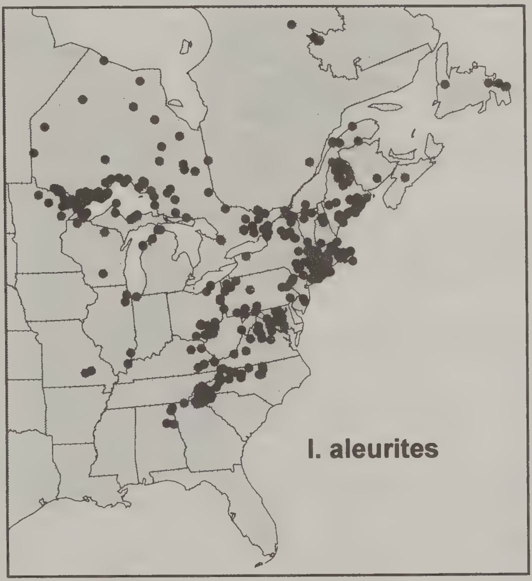
DISTRIBUTION AND SUBSTRATES: Compared with *Parmeliopsis*, the North American distribution of *Imshaugia* is more widespread in northern and central temperate regions, extending into southern Wisconsin, Missouri, Illinois, Indiana, Ohio, and most of southern New England, but absent from most of the distribution of *P. subambigua*, which extends south to Louisiana, Mississippi, southern Alabama, and Florida. Like *Parmeliopsis*, *Imshaugia* favors conifer bark and lignum as substrates.

Imshaugia aleurites (Ach.) S. F. Meyer, Mycologia 77: 338 (1985); *Lichen aleurites* Ach., Lichenogr. suec. prodr.: 117 (1799 ['1798']). **Type** (Meyer 1985): Sweden, on *Pinus sylvestris* bark (H-ACH 1315B, lectotype). **Syn**: *Parmelia aleurites* (Ach.) Ach., Methodus: 208 (1803). *Squamaria aleurites* (Ach.) Nyl., Mém. Soc. Imp. Sc. Nat. Chergourg 3: 177 (1855). *Parmeliopsis aleurites* (Ach.) Nyl., Not. Sällsk. Fauna Fl. Fenn. Förh. 8: 121 (1866). *Cetraria aleurites* (Ach.) Th. Fr., Lich.

Scand. 1: 109 (1871). *Parmeliopsis aleurites* var. *diffusa* (Ach.) Riddle, Bryologist 20: 74 (1917); *Parmelia aleurites* var. *diffusa* Ach., Lich. Univ.: 485 (1810). *Parmelia placorodia* Nyl., Not. Sällsk. Fl. Fenn. Förh. 5: 106 (1861) [not *Parmelia placorodia* Ach.].

MORPHOLOGY: Thallus adnate on trees, especially conifers, or lignum (rarely rocks), mineral gray, up to 8 (12) cm broad, with divergent, contiguous, or overlapping, adnate lobes 0.5-1.5 mm wide. Upper surface with simple, cylindrical, laminal isidia that may have brown or black tips. Lower surface whitish to light brown. Apothecia (up to 7 mm wide) and pycnidia uncommon; spores (5.0-9.0) 6.5 X 4.0 (3.5-6.0) µm.

CHEMISTRY: Thamnolic acid (K+ deep yellow, P+ orange) and atranorin.



DISTRIBUTION: (map based on 443 sites: CIEGLER, FH, H, HINDS, LADD, MAINE, MIN, NY, US, Ahti 1964, Brodo 1968, Calkins 1896, Degelius 1940, 1941, Dey 1978, Dirig 1994, Evans & Meyrowitz 1926, Gowan & Brodo 1988, Hale 1950, Harris et al. 1988, Ladd 1991, Metzler 1980, Meyer 1979, Mozingo 1948, Nash 1972, Rao & LeBlanc 1967, Mc-Cullough 1964, 1967, Selva 1988, 1989, Showman 1973, 1997, Taylor 1967, Thomson 1984, Wetmore 1988, Wilhelm & Parker 1989, Wong & Brodo 1992): in eNA common in temperate and boreal habitats of northern U.S. and Canada and also found in the Appalachians south to Alabama, South Carolina, and Georgia. It is the only species of *Imshaugia* (or *Parmeliopsis*) that has been found in Indiana, Illinois or Missouri. Also widespread in western NA, Europe, eastern Asia, and Australia.

REMARKS: *I. aleurites* has the widest ecological amplitude in eNA of any species of *Parmeliopsis* or *Imshaugia*, being found from tree line in the Arctic south through all of the boreal region and most of the temperate region. It is absent only in the SE coastal plain. Riddle (1917) noted that some specimens of *I. aleurites* had divergent lobes and sparse isidia and named this form *Parmeliopsis aleurites* var. *diffusa* (Ach.)

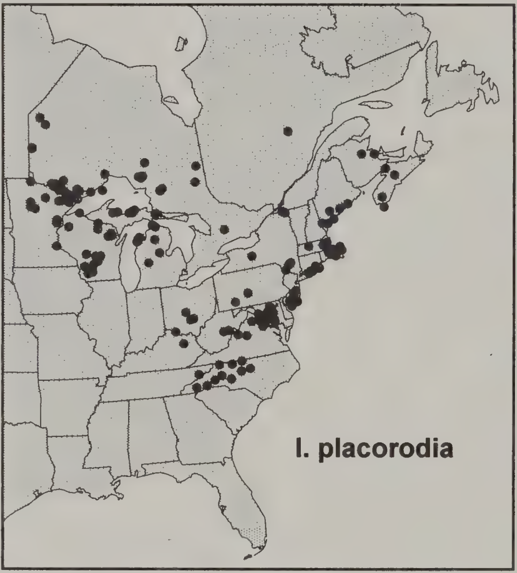
Riddle. In the present study this form is illustrated in Figure 6 but is not given taxonomic recognition.

Imshaugia placorodia (Ach.) S. F. Meyer, Mycologia 77: 338 (1985); *Parmelia placorodia* Ach., Syn. Meth. Lich.: 196 (1814). **Type** (Meyer 1979, 1985): North America (H-ACH 1334, lectotype). **Syn**: *Cetraria placorodia* (Ach.) Tuck., Proc. Am. Acad. Arts & Sci. 1: 208 (1847). *Squamaria placorodia* (Ach.) Nyl., Flora 43: 546 (1860). *Parmeliopsis placorodia* (Ach.) Nyl., Syn. Meth. Lich. 2: 55 (1869). *Cetraria aleurites* var. *placorodia* (Ach.) Tuck., Syn. N. Am. Lich. 1: 105 (1882). *Parmelia angustior* Nyl., Ann. Sci. Nat. Bot., Ser. 4, 11: 215 (1859). *Parmeliopsis marylandica* Gyelnik, Ann. Mycol. 30: 459 (1932). *Parmeliopsis placorodia* f. *marylandica* (Gyelnik) Gyelnik, Lilloa 3: 71 (1938). *Parmeliopsis americana* Hillm., Rep. Sp. Nov. Regni Veget. 33: 171 (1933).

MORPHOLOGY: Thallus adnate on trees, especially *Pinus*, or lignum, mineral gray, up to 5 cm broad, with contiguous or overlapping lobes, 0.5-1.5 mm wide. Upper surface with abundant apothecia, up to 12 mm in diameter and emergent pycnidia either laminal or marginal. Lower surface whitish to light brown. Spores (5.0-8.0) 6.5 X 4.5 (3.5-6.0).

CHEMISTRY: Thamnolic acid (K+ deep yellow, P+ orange) and atranorin.

DISTRIBUTION: (map based on 196 sites: CIEGLER, CLAYDEN, FH, H, HINDS, MIN, NY, US, Ahti 1964, Brodo 1968, Culberson 1956, Dirig 1994, Harris et al. 1988, Meyer 1979, Nimis 1985, Taylor 1967): locally common on pines from western Ontario (52° 37' N.) to Nova Scotia, south to the lower elevations in the southern Appalachians. *I. placorodia* is also found in the Rocky Mountains from Colorado and South Dakota to Arizona (Meyer 1979), but is not known outside North America.



REMARKS: The substrate specificity of *I. placorodia* for the bark of *Pinus rigida* P. Mill. and *P. banksiana* Lamb. is remarkable. As pointed out by Culberson (1956), at the northern and western limit of its range in eNA, where *Pinus rigida* does not occur (Flora of N.A. Editorial Committee 1993), it is exclusively found on *Pinus banksiana*; and along the Atlantic coast from Maine to North Carolina, it is usually found on *Pinus rigida*. Culberson (1956) found that of the 66 collections studied, 79% were on pine bark, 18% on lignum, 3% not determinable as to substrate, and none on deciduous tree bark. Brodo (1968), however, reported that in Long Island, NY, *I. placorodia* is found rarely on highbush blueberry and oak bark.

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STUDIES IN NORTH AMERICAN CORTINARII V. NEW AND INTERESTING PHLEGMACIA FROM WYOMING AND THE PACIFIC NORTH WEST

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ABSTRACT. The taxa of *Cortinarius*, subgenus *Phlegmacium* reported here include five new species, *C. calojanthinus, C. citriolens, C. pseudovariegatus, C. variosimilis* and *C. sannio,* and three new varieties, *C. subfoetidus* var. *bubalinovelatus, C. cephalixus* var. *aurantiobrunneus* and *C. infractus* var. *flavus*. Included as well are comments on *C. subfoetidus* var. *subfoetidus, C. albobrunnoides* and *C. cephalixoides* and a closely related variant. *Cortinarius superbus* and *C. percomis* are reported from the Rocky Mountians for the first time, *C. superbus* f. *aromaticus* is described from Oregon, and the taxonomic position of the complex around *C. subfoetidus* and *C. citriolens* is discussed.

Key Words: *Cortinarius, Phlegmacium*, California, Idaho, Oregon, Washington, Wyoming, Rocky Mountains, Olympic and Cascade Mountains, Pacific Northwest.

Introduction

This paper presents a series of Phlegmacia that are characteristic of conifer forests of the Pacific Northwest and the Rocky Mountains, or to date are known from one or the other of these regions. Some taxa, for example *Cortinarius superbus* A.H.Smith, appear to be widely distributed but relatively uncommon in at least some parts of their range, others such as *Cortinarius variosimilis* are relatively common and widely distributed in conifer forests. These taxa all appear to be more or less characteristic of montane and subalpine conifer forests and likely grow throughout western North America where suitable habitats occur. Habitats for some of these taxa, for example, *Cortinarius subfoetidus* var.

bulbalinovelatus, may include species of hardwoods as well as conifers. Other papers by the authors, containing *Phlegmacium* species from western North America, include Moser et al. 1995, Moser and Ammirati 1996, Moser and Ammirati 1997, and Moser 1997a, 1997b.

The vegetation of the Pacific Northwest and Rocky Mountains has been classified by several plant ecologists (Franklin and Dearness, 1973, Barbour and Billings, 1988, Henderson et al., 1989). Forest habitat types have been studied by Steele et al. (1983). The *Phlegmacium* species reported from the Rocky Mountains are primarily from spruce-fir (*Picea/Abies)* subalpine forest habitats. In some areas *Pinus contorta* Dougl. is commonly mixed in with *Picea engelmannii* Parry and *Abies lasiocarpa* (Hook.) Nutt., the most common spruce and fir species. *Pseudotsuga menziesii* (Mirbel)Franco, *Pinus albicaulis* Engelm. and *P. flexilis* James occur in some habitats and *Alnus sinuata* (Regel) Rydb. and *Salix* species can be found in moist habitats, along streams, lake edges or seepage areas. The northern Idaho Cascade forest elements may be found in moister habitats. A first tentative attempt to correlate the occurrence of *Cortinarius* species with vegetation types has been made some years ago for the Greater Yellowstone area. (Moser et al. 1994).

In the Pacific Northwest, the vegetation of the Olympic and Cascade Mountains includes *Pseudotsuga menziesii-Tsuga heterophylla* forests from sea level up to 1000 m, and *Abies amabilis-Tsuga heterophylla* forests in montane regions, the latter often with *Abies procera* Rehder, *A.grandis* (Dougl.)Forbes, *Pseudotsuga menziesii, Pinus monticola* Dougl. and *Thuja plicata* Donn. depending on the site. At higher elevations or in more continental environments, *Pinus contorta, P. monticola, P. ponderosa* Dougl., *Abies lasiocarpa, A. grandis, Larix occidentalis* Nutt. and *Picea engelmannii* may be found in various combinations along the Cascades of Oregon and Washington. *Picea sitchensis-Tsuga heterophylla* forests occur in a rather narrow band along the Pacific Coast south to northern California. These forests may occur as pure stands of *Picea*, or as mixed stands that include *Thuja plicata, Myrica californica* Cham., *Pinus contorta* or *Pseudotsuga menziesii* in addition to *Tsuga heterophylla* (Raf.)Sarg.In inland coastal areas of northern California certain of these Phlegmacia, for example, *C.percomis* and *C. subfoetidus,* occur in forests with a mixture of conifers (*Pseudotsuga menziesii*) and hardwoods (*Castanopsis, Lithocarpus, Quercus*) species.

Materials and Methods

For methods of study see Moser 1993, Moser et al. 1995 and Moser and Ammirati 1996. Descriptions of microscopic characters were from sections mounted in 3% KOH. Spore measurements were made from spore deposits whenever possible. Abbreviations used to describe the basidiospore measures include: S = standard deviation, Q = quotient of spore length to spore width, V = approximate volume. To describe the density of the lamellae the following measurements are given: L = total number of lamellae reaching the stipe; l = number of lamellulae between two lamellae. Comparison of lamella width with the thickness of the pileus context was made at about half the radius of the pileus. Color codes include Munsel Soil color Charts (1975, example of notation, Mu 2.5YR2/4), Ridgway, Color Standards and Color nomenclature (1912, example, Carob Brown (R)), A. Cailleux, Code des Couleurs des Sols (1981, example, Caill 55S) and Methuen Handbook of Color (example, M 1D8). Macrochemical color reactions were made with 20% or 30% KOH and/or NH_4OH. Collections of Meinhard Moser are deposited in the Herbarium of the Institut für Botanik der Universität Innsbruck (IB) and those of Joe Ammirati and M. T. Seidl at the University of Washington Herbarium (WTU).

Taxonomic treatment.

1. Cortinarius Fr. subgen. Phlegmacium (Fr.:Fr.) J.G.Trog sect. Caerulescentes R.Hry. ex Brandr. & Melot

Cortinarius (Phlegmacium) calojanthinus **Mos. & Ammirati spec. nov.** (Fig.1, 2(1), 8a)

Pileo 40-85 mm lato, primo hemispherico, convexo, margine involuto, plano-convexo usque applanato, interdum centro depresso, margine primo pallide lilaceo, discum versus ochraceo vel brunneolo jam juventute, aetate totius flavo-brunneo, interdum fere albidulo; lamellis pallidis, bubalinis, dein argillaceis, adnatis vel leviter emarginatis, confertis, acie serrulato, 6-8 mm latis; stipite 40-70 mm longo, 15-25 mm crasso, bulbo marginato 25-50 mm lato, albo vel albidulo, sericeo, margine bulbi primo pallide lilacino, deinde albido, velo lilaceo usque albidulo; carne alba usque pallide bubalina, odore nullo vel leviter fragrante, sapore miti; Sporis 10.6-12.9x6.2-7.2 μm, in medio 11.7x6.8 μm (n=31), amygdaliformibus sublimoniformibusve, verrucosis. Basidiis 34-

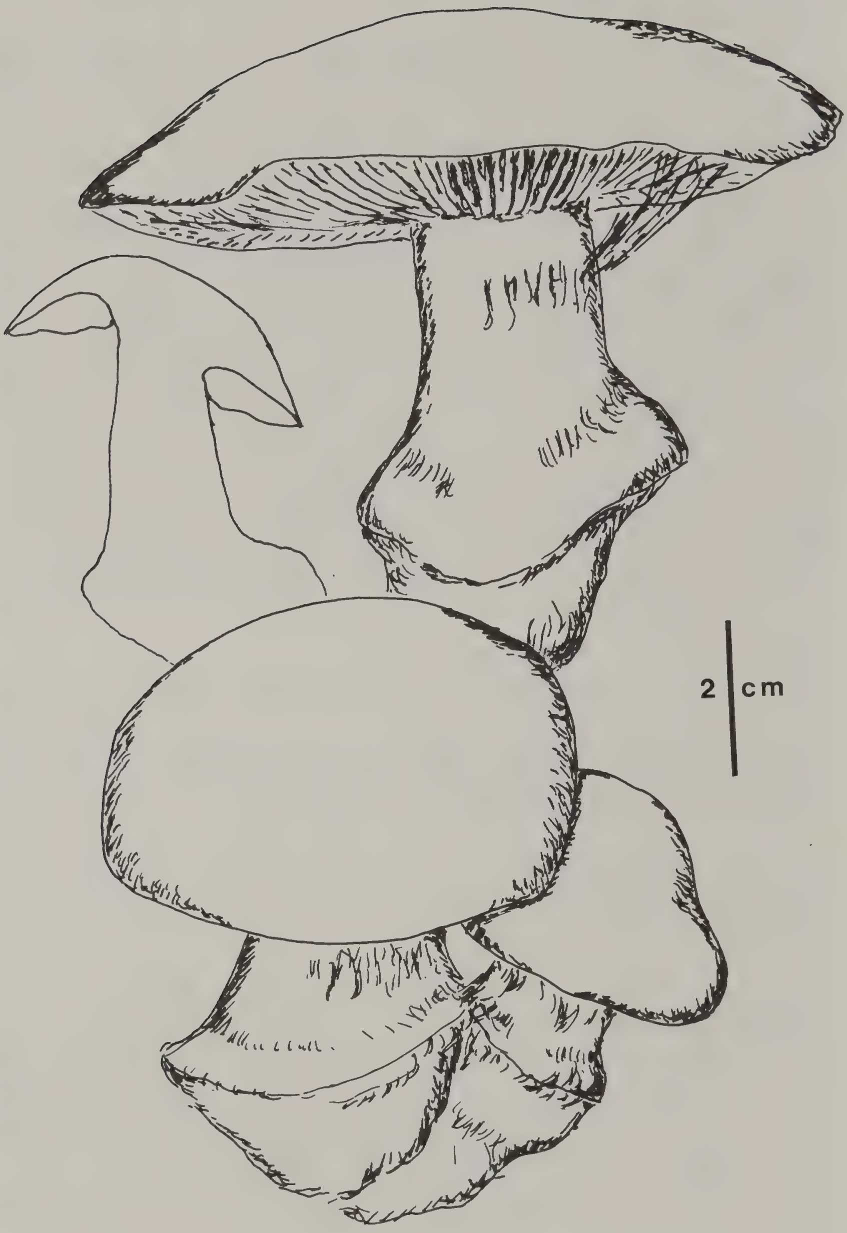

Fig.1. *Cortinarius calojanthinus.* Fruit-bodies (97/220) (nat.size)

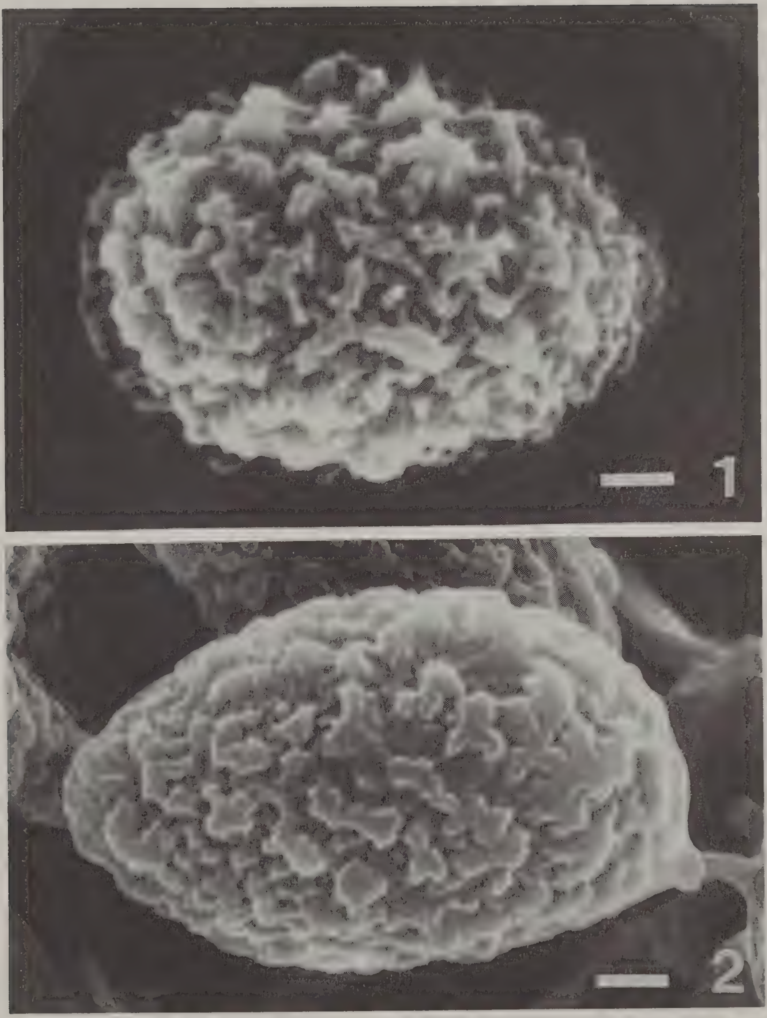

Fig.2. Spores in SEM of: 1. *Cortinarius calojanthinus* (97/220).-
2. *Cortinarius citriolens* (97/122). (Bar= 1 μm)

40x10-11 µm, clavatis, absque cheilocystidiis, fibulis praesentibus. Habitatio: in silvis coniferis subalpinis (*Picea engelmannii, Abies lasiocarpa*). Holotypus IB 97/220, Flagstaff Road, in silva nationalis "Teton", 21.8.1998, leg. M. Moser & J.Ammirati.

Pileus 40-85 mm diam., at first hemispheric, convex with involute margin, later convex to applanate, sometimes center becoming depressed, nonstriate, surface glutinous, in young specimens margin dingy pale lilac, R Lavender to Bluish Lavender (R) (somewhat paler), disc already in young buttons ochraceous to pale brownish, between Pinkish Buff (R) and Warm Buff (R), Caill 69M, later disc yellow-brown marbled (Caill 57N), with age becoming totally yellow-brown, Caill 65M, 60N, center also browner, Caill 57N, with Clay Color to somewhat reddish brown colors developing centrally in age, sometimes, however, much paler, nearly whitish, Caill 69M and margin with slight grayish flush, lilac colors fade quickly and disappear in mature basidiomata completely, not or only slightly innate fibrillose, sometimes center becoming slightly areolate. **Lamellae** pallid already in buttons, Pale Pinkish Buff (R), later argillaceous, near Avellaneous (R) or between Avellaneous (R) and Vinaceous Buff (R), with age Clay Color (R); edges eroded to serrulate, rounded adnate to slightly emarginate, close to crowded, L=120-130, l=1-3, 16-17/cm at margin, 6-8 mm wide, equals 1-1.5 times pileus context thickness. **Stipe** 40-70 mm long, 15-25 mm thick, the marginate bulb 25-50 mm, white to whitish, silky, bulb margin in young specimens slightly lilac, in age dingy whitish, bulb underneath white. **Veil** lilac to whitish. **Context** up to 12-13 mm on disc, abruptly then gradually thinner to edge, solid, firm, white to whitish or pale buff in pileus, Pale Pinkish Buff (R), in stipe, whitish to slightly buff and with yellow-brown to brownish discolorations in base, sometimes watery mottled in cortex. Without distinctive **odor** or odor very faint, difficult to define, taste mild.

Chemical characters: KOH on pileipellis somewhat brown, on context negative, NH_4OH negative. Under UV pileus dingy red, with age more yellow-brown with some red, mixed with some bright yellow areas, stipe violaceous, bulb margin and underneath bright yellow.

Microscopic characters: Basidiospores 10.6-12.9x6.2-7.2 µm, mean 11.7(S=0.66)x 6.8(S=0.3) µm, Q=1.5-1.9, mean 1.7 (S=0.08), V=223-349 μm^3, mean 287 μm^3, almond-shaped to slightly sublimoniform, verrucose, apex smooth. Basidia 34-40x10-11 µm, clavate. Without cheilocystidia. Lamellae edge with basidia and basidioles and some degenerated basidia; Lamellar trama with lateral stratum hyphae (5)6-8 µm wide, in mediostratum up to 12 µm, occasionally up to 21 µm wide, colorless, clamp connections present. Pileipellis with gelatinous pellicle of 3-4.5(-5) µm thick, colorless hyphae with clamp connections, subrepent in basal layer to somewhat ascending in upper layer, epicuticular hyphae 6-8 µm thick, walls ochraceous in KOH, without distinct hypocutis or hyphae up to 12 µm thick. Cortina hyphae 3-4.5 µm thick, colorless, with clamp connections.

Habitat: subalpine forest under *Picea engelmannii* and *Abies lasiocarpa.*

Collections examined: IB 97/220 (holotype) and JFA 12443 (WTU), Flagstaff Road, Calypso Creek, Teton National Forest, leg. M. Moser & Ammirati, 21 Aug. 1997 and 97/220b, same locality on 26 Aug. 1997, leg. M. Moser.

Comments: *Cortinarius calojanthinus* belongs to section Caerulescentes Hry. ex Brandr.& Melot because of the lilac coloration and negative reaction with KOH and NH_4OH. It is similar in macroscopic appearance to members of the *Dibaphus* group, but these taxa give a strong pink to red reaction with KOH.

2. The complex around *Cortinarius subfoetidus* A.h.Smith.

Species with bright blue or bluish violet colors on pileus, lamellae and stipe, with clavate, dry stipe and glutinous pileus. Stipe equal or clavate. Spores amygdaliform to sublimoniform. Without reactions with KOH, NaOH and NH^4OH. Often with fragrant odor.

Key to North and South American taxa (several taxa from the Borneo and Malaysia are not yet published.)
1. Stipe blue to violet, glutinous. Spores subglobose to elliptic or almond-shaped Subgen. Myxacium sect. Archeriani
1* Stipe dry **2**
2. Spores fusoid to slender elliptic. Lamellae argillaceous, rarely pale bluish. Stipe pallid, without or with few patches only of bluish veil group Cumatilis
2* Spores ellipsoid to almond-shaped. Lamellae pale to dark bluish at least when young. Stipe distinctly blue up to the cortina or even to apex **3**
3. Basidiomata with fragrant odor, growing under conifers in North America **4**
3*.Without fragrant odor. Under *Nothofagus* in South America **5**
4. Spores 10.6-13.1x5.9-7.1 mm, almond-shaped to sublimoniform. Strong odor of lemon pelargonium *C. citriolens* Ammirati & Mos.
4*. Spores 7.6-10.6x4.4-5.9 µm, ellipsoid to subalmond-shaped. Odor sweetish aromatic to foetid (difficult to describe) *C. subfoetidus* A.H.Smith
With buffy veil var.*bubalinovelatus* Mos. & Ammirati
5. Spores 8.8-12x(3.5)-4.3-5.6(-6) mm, ellipsoid to almond-shaped. Odor somewhat polyporoid. Pileus 4-8 cm withbright violet to blue colors *C. columbinus* Mos. & Horak
5*. Spores 7-8.8(-9.2)x4.8-5.6 µm. Without distinct odor. Colors bluish violet, gray-

blue, margin slightly striate. Pileus 2-6 cm. *C. caelicolor* Horak & Mos.

Cortinarius (Phlegmacium) citriolens Ammirati & Mos. sp. nov. (Fig. 2(2), 3, 8b)

Pileo 50-160 mm lato, primo hemispherico, dein convexo, margine involuto, aetate applanato, glutinoso, laete violaceo maculis obscurioribus praedito, disco sordide albido-griseo, demum griseo vel ochraceo, margine innato fibrilloso, juventute appendiculato e velo violaceo; lamellis juventute pallide caeruleis, in pileo expanso plus minusve decoloratis, bubalinis, adnatis usque emarginats, confertis, 7-10 mm latis; stipite 50-95 mm longo, 20-50 mm crasso, aequali sive clavato, interdum apice dilatato, ad apicem albidulo, infra cortinam caeruleo-violaceo, basi albido vel ochraceo; carne pilei corticeque stipitis leviter caerulea, aliter albida; odore forte dulcidulo, citriodoro, similis Pelargonii odorati; velo albido usque caeruleo; sporis amygdaliformibus, raro sublimoniformibus, 10,6-13,1x5,98-7,1 μm, medio 11.8x6.5 μm, basidiis tetrasporigeris, 34-38x8-10,5 μm, subcylindraceis vel clavatis, absque cystidiis, fibulis praesentibus.
Habitatio: in silvis coniferis subalpinis (*Picea engelmannii, Abies lasiocarpa*). Holotypus IB 97/122, Flagstaff Creek, Teton National Forest, 6.Aug.1997, leg. M. Moser & J.Ammirati.

Pileus 50-160 mm diam., at first hemispheric, later convex with involute margin, finally expanding and margin straight and applanate with age, glutinous, with bright violet colors,(R) Deep Grayish Lavender with small and some larger darker spots, from (R) Dark Grayish Lavender, (R) Ramier Blue to (R) Deep Hyssop Violet, (R)Grayish Blue Violet, (R) Wisteria Violet, toward the disc even in buttons with a dingy whitish-gray overcast, later more grayish or more ochraceous, Caill near 75L, Mu 10YR 7/4, (R) Tileul Buff, toward margin innate fibrillose, margin in young specimens appendiculate from veil, in older specimens only toward margin deep violet, (R) Deep Lavender to (R) Lobelia Violet, disc (R) Clay Color to (R) Cinnamon Buff, in age over most of the surface discoloring to (R) Pinkish Buff with some darker spots. **Lamellae** in buttons pale bluish, (R) Deep Grayish Lavender, (R) Lavender Gray, (R) Plumbago Blue, but when opening mostly discolored, (R) Tileul Buff or between (R) Tileul Buff and (R) Vinaceous Buff to (R) Pinkish Buff, with age (R) Cinnamon Drab, some violet shades may be retained near the pileus margin, emarginate, edges entire to eroded, adnate to emarginate, crowded, L=110-120, l=1-3, 14-20/cm at pileus margin, 7-10 mm wide (= about thickness of pileus context). **Stipe** 50-95 mm long, 20-50 mm thick, equal or slightly clavate, sometimes apex also enlarged, apex whitish, below the cortina bluish, (R) Deep Grayish Lavender, (R) Bluish Lavender, (R) Pale Wisteria Violet, (R) Verbena Violet, the base whitish to ochraceous yellowish, slightly wrinkled or floccose below the cortina.

Veil white to pale bluish. **Context** bluish in pileus and cortex of stipe of young fruit-bodies, otherwise white to (R) Pale Pinkish Buff. **Odor** rather strong and fragrant, sweetish of lemons or lemon pelargonium (*Pelargonium odoratum*). Taste mild.
Chemical reactions: KOH negative on context, but discoloring the blue parts of the pileus and stipe to ochraceous. Under UV pileus red and yellow, stipe violaceous, context blue, in older specimens rather negative.
Microscopic characters: Basidiospores 10.6-13.1x5.9.2-7.1 μm, mean 11.8(S= 0.6) x 6.5 (S= 0.25) μm, Q= 1.6-2 , mean 1.8 (S= 0.08), V= 197-337 μm^3, mean 267 (S= 31) μm^3 almond-shaped, rarely slightly sublimoniform, verrucose. Basidia 4-spored, subcylindric to clavate, 34-38x8-10.5 μm. Without cheilocystidia in older specimens, in young specimens with cylindric or clavate to somewhat ventricose cells 30-45x4-15 μm. Subhymenial hyphae 2.5-4 μm, in lateral strata hyphae 5-6-(7) μm, in mediostratum 7-9 (-13) μm, colorless in KOH, clamp connections present. Pileipellis with gelatinous pellicle of repent to subrepent or slightly irregular hyphae of 2.5-4.5 μm width, colorless, clamp connections present, epicuticular hyphae 4-7 μm, walls in KOH pale ochraceous, hypocutis not much different, hyphae 7-9.5 μm, less colored. Cortina hyphae 4-5 μm, colorless, with clamp connections.

Habitat: subalpine conifer forests, *Picea engelmannii, Abies lasiocarpa*,.

Collections examined: IB 97/122 , leg. M. Moser & J.Ammirati, Flagstaff Creek, Teton National forest, 6 August 1997,(holotype), 97/154, same area 10 August 1997, leg. M. Moser, 97/339, near small lake below Lost Lake, Togwotee Pass area, 7 Sept. 1997 leg. M. Moser

Comments: This beautiful species seems to be related to *C. subfoetidus* A.H. Smith. This may be corroborated by the bright colors. In both species the stipe is blue up to the cortina (which sometimes is suggesting of taxa of subgenus Myxacium (e.g. *C. salor*-group). Both have a fragrant odor. The odor, however, is different, in *C. subfoetidus* also somewhat sweetish, but difficult to define. Spores in *C. subfoetidus* are distinctly smaller and more elliptic, 7.6-10.6 x 5-5.8 μm, mean 9.0(S=0.3)x5.4(S=0.2) μm, Q=1.6-1.9, mean 1.7, V= 123-184 μm^3, mean 145 (S=13) μm^3. This species has not been observed in Wyoming but we have studied numerous collections from Washington and Oregon.
A chemical analysis of the violet pigment would be desirable. In *C. subfoetidus* we observed that the pigment is rather persistent and does not discolor even after some days in contrast to most other blue Cortinarii. The junior author has observed a similar taxon in the Cascades and Olympic Mountains, which we at first thought to be identical. There are,

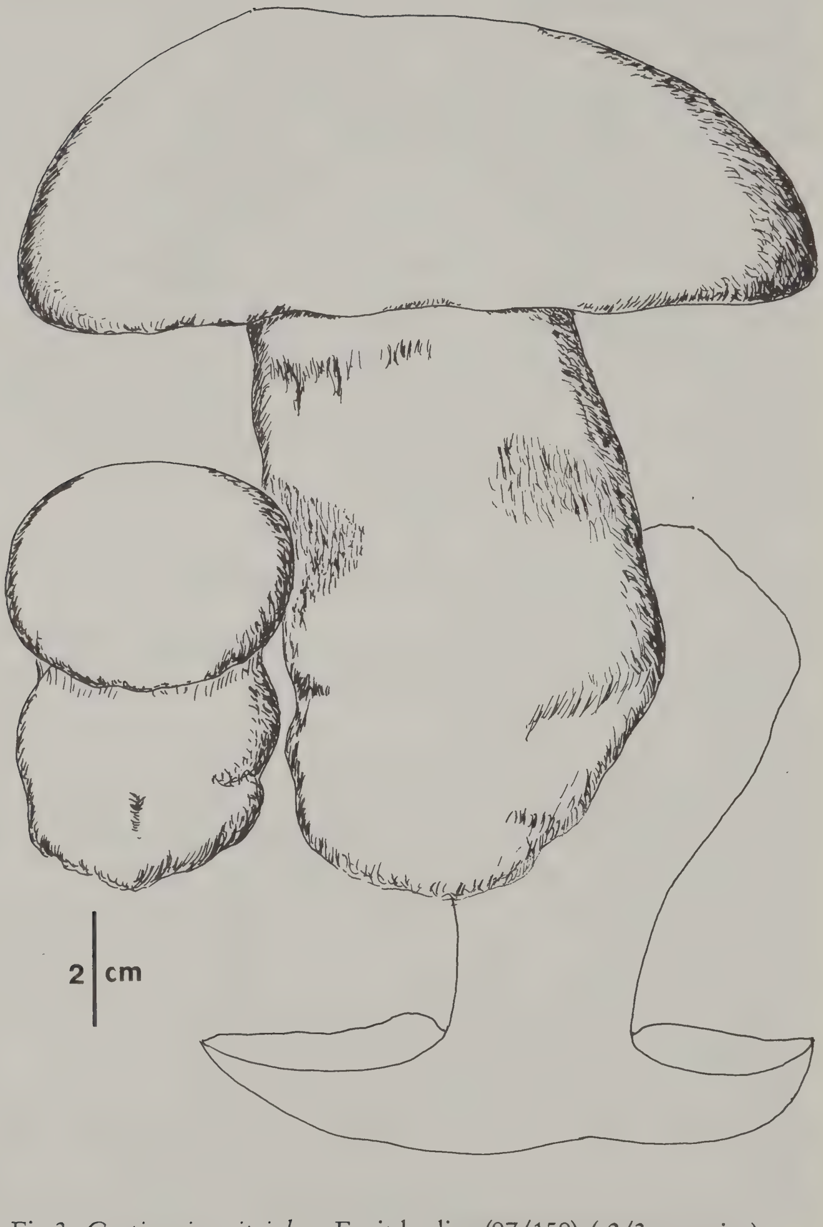

Fig.3. *Cortinarius citriolens* Fruit-bodies (97/159) (2/3 nat. size)

however, several differences and this taxon needs further study. It may be another species or variety of this section.
Molecular studies will be necessary to elucidate eventual relationships to the groups around *C. salor, C. iodes* etc. with glutinous stipe.

Cortinarius (Phlegmacium) subfoetidus **A.H.Smith** 1944 **var.** *subfoetidus*
Lloydia 7, 191-192, 1944.
(Fig. 9 b, c)

Recently a description and colored plate were published in Europe as *C. subfoetidus* (Bidaud et al. 1996), however, these represent a misinterpretation of this American fungus. We are providing a complete description of *C. subfoetidus* below in the hopes of preventing future misinterpretation of this taxon in Europe and elsewhere.

Pileus 70-90-(100) mm, convex with margin involute, then applanate and margin incurved and often remaining sharply so, glutinous, with a very bright and beautiful bluish violaceous color, Wisteria Violet (R), Soft Blue Violet (R), Grayish Blue Violet(1)(R), when drying becoming somewhat paler, but retaining this color even with age, only central part discoloring and becoming grayish blue or grayish, rarely somewhat ochraceous or slightly brownish, sometimes spotted. **Lamellae** in young buttons pale grayish, Pale Violet Gray (R), later near the pileus margin pale grayish-blue, slightly Grayish Lavender (R), but most part buff to gray-brown (Cinnamon Buff (R) to Avellaneous (R)), sometimes with these colors already present when expanding, emarginate, edges uneven to serrulate, close, L=55-70, l=1-3, 1213-15/cm at margin, 5-10 mm wide, strongly tapering toward the pileus margin. **Stipe** 40-130 x 8-25 mm, clavate, bluish violaceous, Dark Grayish Lavender (R), Grayish Lavender (R) sometimes only up to the cortina, occasionally also up to the top, the base dingy whitish to Light Buff (R), dry, smooth to floccose up to the cortina, but occasionally some slightly glutinous spots can be observed due to slime dropping down from the pileus. **Cortina** pale bluish, unversal veil pale bluish. **Context** pale bluish (Grayish Lavender (R)) in pileus, in some areas darker marbled, in stipe whitish. **Odor** strong, sweetish, aromatic, foetid, difficult to describe, but certainly not related to odors occurring in the Variecolor group. Taste mild. **Chemical reactions**: KOH 20% no reaction on context and pileus surface, NH_4OH negative, Lugol negative. Under UV pileus blue (at least partly, lamellae dark, stipe blue, context blue with yellow areas.

Microscopic characters: Spores 7.6-10.6x4.4-5.9 µm, mean 8.7(S=0.7)x5.5 (S=0.3) µm, elliptic to subalmond-shaped, moderately verrucose, basidia 30-35x7-8 µm, subcylindric to clavate, 4-spored, without cheilocystidia, subhymenial hyphae 3-4 µm, colorless, lamellae trama hyphae 3-6 µm, in mediostratum 6-7 µm, colorless. Pileipellis with gelatinous layer of 3-5.5 (-6) µm thick, repent hyphae with clamp connections, colorless but in mass slightly lilac, epicuticular hyphae 4-6 µm, more or less colorless, with clamp connections. Hypocutis not differentiated.
Habitat: in conifer forests under *Pseudotsuga menziesii, Tsuga heterophylla, Pinus monticola.* The main mycorrhizal host seems to be *Pseudotsuga* and/or *Tsuga*.
Collections examined: Washington: Smith 17778 (holotype) Olympic Hot Springs, Olympic Natl. Park, 11 Oct 1941.; IB 95/241, Lake Angeles Trail, Olympic Natl. Park, 5 Oct 1995 leg. M. Moser, 95/326 and JFA 11581 (WTU), Cougar Rock Camp ground, Mt. Rainier Natl. Park, leg. M. Moser 18 Oct 1995 ; **Oregon**: 95/458. Bull. Run Watershed Management, Clackamas Co., 2 Nov. 1995, leg. J. Rogers, 95/494 Bull Run Watershed Management, Clackamas Co., 8 Nov. 1995. leg. M. Moser. In this area the species was extremely frequent and often luxuriant and in larger groups. **Idaho**: Smith 83009. Tule Bay, Priest Lake, Bonner Co., 18 Oct 1972.

Comments: *Cortinarius subfoetidus* certainly does not belong to the Variecolor group because of the type of pigmentation, the lack of the typical yellow reaction of the context with KOH, and the quite different odor. The pigment is rather peculiar. While in other taxa blue pigments tend to discolor rather quickly and to change to brownish or ochraceous tints, however,the very bright blue-violet colors in *C. subfoetidus* do not change except after many days and in age only slightly on the disc. So it seems that the chemical nature of the blue pigments in *C. subfoetidus* is different from those in the Variecolor group. The fungus of our French colleagues on the other hand is a typical member of the Variecolor group (Bidaud et al.1996). The blue covering on the stipe of *C. subfoetidus* invokes the impression of a blue sheath and resembles more the blue stipe of some blue Myxacia and so does the habit of the basidiomata. The spore shape, however, is different from those in the blue Myxacia. And the stipe surface showes no trace of gelatinized hyphae.
With respect to the taxonomic position of the group we consider three possibilities.

1. *C. subfoetidus* together with *C. citriolens* form a distinct group which deserves infrageneric recognition. A comparison must still be made with the taxa of the *C. columbinus, C. caelicolor*-group from South America and some species from Malaysia (Borneo). Moser & Horak (1975) included these with some hesitation in subgenus Myxacium in the Stirps

Iodes in spite of the dry stipe. We think now that this was incorrect and that these species together with C. *subfoetidus* and C. *citriolens* may form a natural group within Phlegmacium which has its distribution area in the pacific region. A special feature of this group seems to be the type of pigmentation. From observations of many collections of C. *subfoetidus* and C. *citriolens* we have the impression that the very bright blue pigment is of another chemical nature as in other blue Cortinarii and does not or only slightly decompose with time. For the South American and Malaysian taxa we have not sufficient observations in this regard.

2. A relationship with the C. *cumatilis*-group. In this group the stipe is not blue except of some veil remains, the gills are normally pale to argillaceous, the pigment type seems different, the spores are more subfusoid to slender almond-shaped.

3. A relationship to Myxacium sect. Archeriani. Moser and Horak (1975) includes C. *columbinus* and related taxa in this section stirps Iodes inspite of a non-glutinous stipe surface. C. *subfoetidus* and *citriolens* often remind much of taxa of the Salor-group, but too have a dry stipe and are much larger. The spores of European and many North American representatives of the Salor-group are more or less subglobose. In North and South America we find taxa with elliptic to amygdali- or even sublimoniform spores, e.g. C. *iodes* Bk. & Curt., C. *iodeoides* Kauffm., C. *austrosalor* Mos. ap. Mos. & Horak., C. *opulentus* Mos. The last two taxa are also rather large. The pigments in C. *iodes* and *magellanicus* are also very bright and relatively stable.
This problem can probably only be solved with a study of the chemical nature of the pigments and with molecular methods.

Cortinarius subfoetidus A.H.Smith var. ***bubalinovelatus*** Mos. & Ammirati n. var. (Fig. 9 a)

Differt a typo colore veli bubalino. Holotypus IB 95/607 Big Flat, Smith River South Fork, Del Norte Co., California, 21 Nov. 1995, leg. M. Moser

This variety agrees with the type variety in all characters except the color of the veil which has a buffy color and forms a thin belt and patches in the lower part of the stipe.

Collections examined: IB 95/607, Big Flat, Smith River South Fork, Del Norte Co., California, under *Pseudotsuga menziesii, Lithocarpus and Castanopsis.* 21 Nov. 1995, leg. M. Moser, JFA 11806 (WTU), same location and date, under mixture of *Pseudotsuga, Pinus, Lithocaprus, Quercus* and *Vaccinium*, leg. J. Ammirati.

3. *Notes on Cortinarius (Phlegmacium) albobrunnoides Mos. & McKnight.*

In 1997 this taxon was very frequent and could be seen on almost every excursion. In other years it was relatively rare in the Greater Yellowstone ares. Moreover it was also observed in the Medicine Bow Mts. and in Colorado in 1997. In addition the variety *violaceovelatus* Mos. & Ammirati, which we knew only from Washington, was frequent in the same areas as the type variety. For descriptions see Moser and Ammirati (1996).

Collections examined: *var. albobrunnoides*: **Wyoming:** IB 97/162, Flagstaff Creek near dam, Teton Natl. Forest, leg. M. Moser 10 Aug 1997, IB 97/303, Lake east of Two Ocean Mtn. Shoshone Natl. Forest, leg. M. Moser, 31 Aug 1997.- **Colorado:** IB 97/194, above Mtn. Research Station, University of Colorado, Nederland, Boulder Co., Colorado, 18 Aug. 1997 leg. M.Moser.
Var. *violaceovelatus* Mos. & Ammirati.: JFA 12401 (WTU) and IB 97/162b, Flagstaff Creek near dam, Teton Natl. Forest, leg. M.Moser 10 Aug 1997, IB 97/207, Medicine Bow Mts., Snowy Range, 19 Aug.1997, leg. M.Moser, 97/264, southwest of Brooks Lake Lodge, Shoshone Nat. Forest, 27 Aug. 1997, leg. M.Moser.

4. *Cortinarius (Phlegmacium) pseudovariegatus* Mos. spec. nov.
(Fig. 4a, 5(3), 8c)

Pileo 34-63 mm lato, convexo, glutinoso, flavo-brunneo, e velo violaceo obtecto, in stratis tenuibus aspectu argenteo-albido; lamellis pallide ochraceis, adnatis usque leviter emarginatis, acie serrulato, confertis, angustis, 3-5 mm latis; stipite 45-60mm longo, 11-20 mm crasso, basi usque ad 25 mm, clavato, primo albido, dein pallide flavescente, basin versus e velo violaceo ornato vel dispersim maculato; carne albida, odore nullo vel panis recentis, sapore miti, KOH ope carne reactionem flavum vel flavo-brunneum, NH_4OH ope leviter flavum praebente; Sporis 9,4-12,3x4,7-5,9 μm, in media 10,9x5,2 μm, fusoideis, fere glabris, subtiliter rugosis, basidiis tetrasporigeris, clavatis, 29-33x7,5-8,5 μm, absque cheilocystidiis, fibulis praesentibus.
Habitatio: in silvis coniferis subalpinis (*Picea engelmannii, Pinus albicaulis).* Holotypus IB 97/296, prope lacum ad orientem montis dicto "Two Ocean Mountain", Shoshone Natl. Forest, Wyoming, USA, altitudine 2950 m, 31.8.1997 leg. M. Moser

Pileus 34-63 mm diam., convex, with marginella inrolled, glutinous, ground color yellow-brown (Caill 59M to 57N or some areas 57P), but the pilei covered to a large extent by the universal veil appearing like sugar coated and iced, veil violaceous particularely over the margin, in thin layers appearing silvery whitish. **Lamellae** rather pale ochraceous, between Light Buff (R) and Light Ochraceous Buff (R), Caill near 67L, adnate to shallowly emarginate, edges eroded, crowded, L=120-130, l=3,

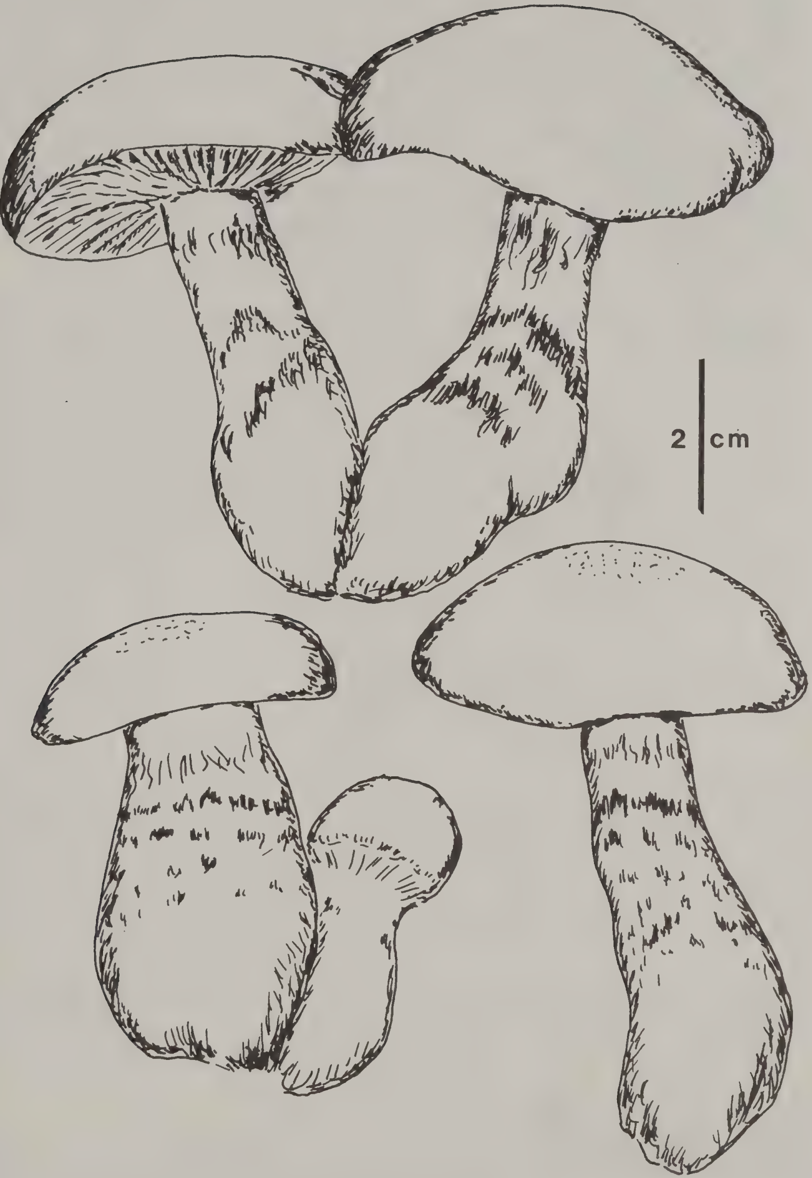

Fig.4.a. *Cortinarius pseudovariegatus*.Fruit-bodies (97/296)
b. *Cortinarius cephalixus* var. *aurantiobrunneus* .
Fruit-bodies (94/189)(nat. size)

17/cm at margin, narrow, 3-5 mm wide (= one third of thickness of pileus context). **Stipe** 45-60 mm long, 11-20 mm above, the clavate base 12-25 mm, whitish at first, then pale yellowish, Cream Color (R), in most specimens toward the base with some patches of the violaceous veil, on one only white patches. **Veil** violaceous (eventually fading to white). **Context** white, in stipe apex slightly marbled, odor very slightly of hot baked bread or none. Taste mild.

Chemical reactions: KOH on context yellow to yellow-brown, NH_4OH slightly yellow, on pileipellis negative. Under UV pileus surface red, stipe, gills and context yellow, veil violet both on pileus and stipe.

Microscopic characters: Basidiospores 9.4-12.3x4.7-5.9 μm, mean 10.9(S=0.7)x 5.2(S=0.35) μm, Q= 1.7-2.6, mean 2.1, V= 119-209 μm^3, mean 157μm^3, fusoid, slightly marbled, nearly smooth. Without cheilocystidia, basidia clavate, 4-spored, 29-33x7.5-8.5 μm, subhymenial hyphae 3-4 μm, hyphae in lateral strata 5-12 μm, in mediostratum 10-14 μm, colorless, with clamp connections. Pileipellis with gelatinous pellicle of 3-4 μm wide more or less repent hyphae, colorless, with clamp connections, epicutis a mixture of hyphae 5-7 μm wide and some subcellular elements 7-20x7-12 μm, hypocutis with larger subcellular elements, 10-25(-80)x10-20 μm, walls yellow-brown.

Habitat: subalpine forest under *Picea engelmannii* and *Pinus albicaulis*.
Collection examined: Holotype: IB 97/296, Lake east of Two Ocean Mountain, Shoshone Natl. Forest, Wyoming, 2950 m, leg. M. Moser, 31 August 1997.

Comments: This species comes very close to *C. variegatus* Bres. It has the same type of colors, the violaceous veil and the same type of spores. However, the spores are significantly larger (*C. variegatus* : Spores 6.2-8x3.2-3.8 μm, mean 7.1(S=0.36)x3.6(S=0.16) μm, Q=1.8-2.3, mean 1.96, V=34-61 μm^3, mean 48 (S=5.8) μm^3), and the veil is more strongly developed particularly on pileus surface..

5. *Cortinarius (Phlegmacium) cephalixus* Fr. var. *aurantiobrunneus* Mos. & Peintner var. nov.

(Fig. 4b,9d)

Differt a typo coloribus pilei velique aurantio-brunneis.
Habitatio in silva humida sub *Picea engemannia* et *Alno sinuata*.
Holotypus IB 94/189 ad occidentem lacus Taggart, Teton Natl. Park, Wyoming , 26 Aug 1994 leg. M. Moser & U. Peintner

Pileus 3-4.5 (-5) cm diam., convex, margin involute, viscid, color orange brown, yellow-brown, Caill 60N on the disc, 65M near the margin, slightly granulose on disc in some specimens. **Lamellae** pale ochraceous to pale argillaceous, adnate to emarginate, edges uneven, crowded, L=100-110, l=3, 25/cm at margin, 3-4 mm wide corresponding to 1/2 thickness of pileus context. **Stipe** 40-60 mm long, 12-15 mm thick, base 15-23 mm, clavate, apex whitish, pallid, below the cortina with yellow-brown belts and patches from the universal veil. **Context** white. **Odor** of freshly cut grass, taste mild. Under **UV** pileus purplish red, lamellae and stipe blue, veil bright orange, context bluish with yellow areas.

Microscopic chracters: Basidospores 8.8-11.7x5-5.9 μm, mean 9.9(S=0.6)x5.3(S=0.25) μm, Q=1.6-2.2, mean 1.85, V= 115-192 μm^3, mean 148 (S=17) μm^3, marbled to finely verrucose, slender, almond-shaped. Basidia 4-spored, clavate, 34-37x7-8 μm, subhymenial hyphae 2.5-4 μm, lamella trama hyphae 5-10 μm, in mediostratum up to 14 μm, more or less colorless, clamp connections present. Pileipellis with gelatinous pellicle of 2.5-4 μm wide, repent hyphae, partly with yellowish content, clamp connections present, epicuticular hyphae 5-7 μm, walls pale yellowish ochraceous, hypocutis hyphae up to 13 μm, more irregular, pale yellowisch. Cortina hyphae 3-4 μm, colorless, clamp connections present, universal veil hyphae from stipe 3-5 μm, walls yellowish ochraceous, clamp connections present.

Habitat: under *Picea engelmannii* and *Alnus sinuata* in a relatively moist site.

Collection examined: IB 94/189 (holotype), west side of Taggart Lake, Teton National Park, Wyoming 26 Aug. 1994, leg. U. Peintner & M.Moser.

Comments: The specimens were rather young and fresh. At first we considered a possible identity with *C. luteoarmillatus* A.H.Smith, a species which also seems to belong to the Cephalixus group. This species, however, has very pale colors on the pileus, a paler yellow universal veil and the spores of the type are slightly smaller and more ellipsoid, 8.2-10.6 x5-5.9 μm, mean 9.1 (S=0.5)x5.5 (S=0.2), Q=1.45-1.9, mean 1.65, V=123-173 μm^3, mean 143 μm^3.). From European *C. cephalixus* our collection differs by more orange-brown colors. The spores fall in the range of European material ((7.4)-8.2-9.4(-11.7)x4.4-5.3(-5.9) μm, mean 8.6(S=0.3)x4.9(S=0.16) μm, Q=1.6-1.9(-2.0) mean 1.8, V=96-133 μm^3, mean 112 (S=9)μm^3, the Q- values and volumes are slightly lower. Although we have only one record we found it so characteristic that it seems worth while to propose a new variety.

6. *Cortinarius (Phlegmacium) variosimilis* Mos. & Ammirati spec. nov. (Fig. 5(4), 8d)

Pileo 30-85 mm lato, hemisphaerico, dein convexo, convexo-umbonato, margine inflexo, glutinoso, laete flavo-brunneo, margine pallidiore; lamellis argillaceis leviter lilaceo tinctis, confertis, 4-8 mm latis; stipite clavato, 40-110 mm longo, 7-20 mm crasso, ad basin usque ad 15-32 mm, albido sive pallide bubalino, infra cortinam e velo albido peronato-floccoso; carne albida, pallide bubalina, absque odore proprio, sapore miti, sporis 8,8-11,25x 5,9-6,9 μm, amygdaliformibus, verrucosis, basidiis 35-38x8.5-9.2 μm, tetrasporigeris, clavatis, absque cheilocystidiis, fibulis praesentibus. Habitatio; in silvis coniferis subalpinis (*Picea engelmannii, Abies lasiocarpa).* Holotypus IB 89/493, in calle jugum versus dicto "Easy Pass", Washington , USA, 12.9.1989, leg. M. Moser.

In Wyoming we observed a Phlegmacium relatively frequently that we regarded as a pale form of *C.varius* Fr. A detailed study, however, revealed, that there are several differences between these two taxa, including the paler colors both of pileus surface and particularly the lamellae, weaker reactions with KOH and NH_4OH, and constant and significant differences in spore size.

Pileus 30-85 mm diam., hemispheric, convex to convex umbonate, margin incurved but not inrolled, glutinous, bright yellow-brown, center Caill 59P,57N, 60L - 65M,60N, toward margin paler and often covered by strong white veil remains, Caill 57N, 59M, 60N, 60M, Mu 2.5Y 8/8, not innate fibrillose. **Lamellae** pale lilac to argillaceous with slight lilac tinge, rarely R Plumbago Blue, Caill 70M, 53M, Mu 10YR7/6, rather pale, later gray-brown, Avellaneous, Caill 70 L to 70M in older specimens 69M or Mu 10YR 7/4, Met 18A2 or paler, edges strongly eroded to serrulate, emarginate, crowded, L=90-100, l=3, 4-8 mm wide (1/2-2/3-1 x pileus context). **Stipe** clavate, 40-110 mm long, 7-20 mm thick, the clavate base 15-32 mm, white or Pale Pinkish Buff (R), below the cortina floccose from strongly developed, peronate wooly whitish veil, sometimes with an almost membranaceous ring when fresh, discoloring buffy ochraceous. **Universal veil** white. **Context** whitish, Pale Pinkish Buff (R) to slightly yellowish in the base. Without distinctive odor, taste mild. **Chemical reactions**: KOH pale yellow on context, NH_4OH pale yellow on context. Under UV: pileus and stipe purplish with yellow areas, context bluish-violaceous with yellow areas.

Microscopic characters: Basidiospores 8.8-11.2 x 5.9-6.9 μm, mean 10.1 (S=0.5)x6.3(S=0.2) μm, Q=1.4-1.8, mean 1.6 (S==.08), V= 170-252 μm^3, mean 212 (S=20.6) μm^3, almond-shaped, verrucose. Basidia (30)-35-38-(39)x(8.5)-9-10-(10.4) μm, 4-spored, clavate, subhymenial hyphae 3-4 μm,

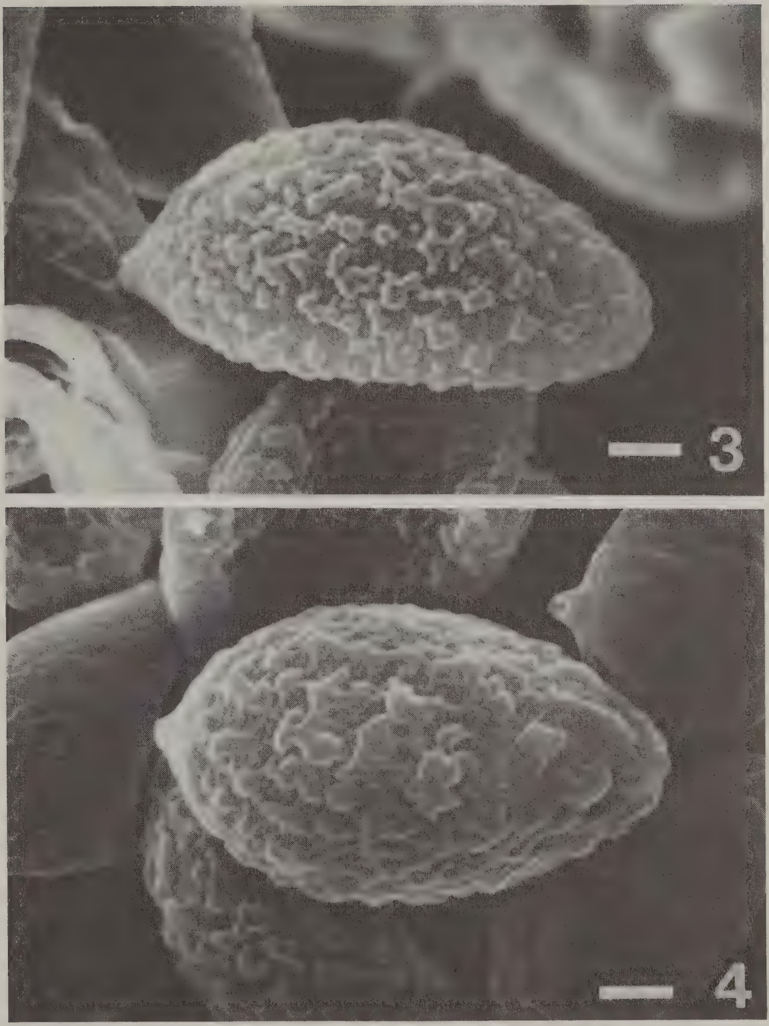

Fig. 5. Spores in SEM of : 3.*Cortinarius pseudovariegatus* (97/296)
4. *Cortinarius variosimilis* (89/493). (Bar = 1 μm)

lamellae trama hyphae 4-8 μm, in mediostratum up to 12 μm. Pileipellis with gelatinous pellicle of hyphae 3.5-4.5 μm thick, colorless but with colorless to yellowish granulose encrustation, with clamp connections. Epicuticular hyphae 5-10 μm, walls from colorless to pale yellow-brown, often encrusted, in hypocutis hyphae 12-15-21 μm, walls ochraceous to darker yellow-brown, encrusted. Cortina hyphae 3.5-4.5 μm, colorless, with clamp connections.

Habitat: conifer forest under *Picea engelmannii, Abies lasiocarpa* in Wyoming. In Oregon, Washington and California the habitats for this species are more variable, ranging from coastal interior forest with *Pseudotsuga, Lithocarpus, Umbellularia* and *Quercus* in California, to *Pseudotsuga* or mixed *Pseudotsuga, Tsuga* and *Abies* forests in Oregon and Washington.

Collections examined: Wyoming : IB 83/181 and 83/181a, Snake River, Southeast of Signal Mtn, Teton Natl. Park, 3 Aug. 1983 leg. M. Moser,.IB 83/187, IB 87/70, Snake River southeast of Signal Mtn., Teton Natl. Park. 24. Jul. 1987 leg. M. Moser, IB 87/150, Lower Slide Lake, Gross Ventre Valey, Teton Natl. Forest. 4 Aug. 1998 leg. H.Thiers, IB 87/169, Mt. Washburn, west slopes, Yellowstone Natl. Park, 6 Aug. 1987, leg. M. Moser, IB 87/181, Flagstaff Rd., Teton Natl. Forest., 8 Aug. 1987, 87/234, Gros Ventre Valley near Upper Slide, Teton Ntl. Forest, 15.Aug. 1987 leg. M. Moser IB 87/323, trail to Union Peak, Teton Natl. Forest, 26 Aug. 1987, leg. M. Moser,, IB 89/259 Trail to Turbid Lake, Yellowstone Natl. Park, IB 97/121, Fourmile Meadow, Teton Natl. Forest, leg. M. Moser, 5 Aug. 1997. JFA 12398 (WTU),Taggart Lake, Teton Natl. Park, leg. J. Ammirati 9 Aug. 1997. **Washington**: IB 89/493 (holotype) Trail to Easy Pass, Skagit Co., Washington, 12.Sept 1989, IB 95/230, Olympic Hot Springs, Olympic Natl. Pak., Clallam Co., Washington, 3.Oct. 1995 leg. M. Moser.- **Oregon**: IB 95/384, Bear Springs, Mt. Hood, Wasco Co., Mt. Hood, Oregon, 27 Oct 1995, leg. M. Moser; JFA 11643 (WTU) same locality and date. IB 95/401 Clear Creek Camp ground, Wasco Co., Mt.Hood, 28 Oct. 1995 leg. M. Moser. **California**: IB 95/566 and JFA 11770 (WTU), Patrick's Creek Camp Ground, on High Way 199, Del Norte Co., California, 17.11. 1995, leg. M. Moser and J. Ammirati

Comments: A collection (IB 87/242 Trail to Arizona Lake, Teton Natl. Forest, 16. Aug. 1987 leg. M. Moser), has somewhat larger spores (10.6-11.8(-12) x 5.6-6.8 μm which come closer to *C. varius*. Spore measurements in European collections of *C. varius* : 10-12-13x5.5-6 μm. Context with KOH, NaOH and NH_4OH deep chrome yellow.

7. Key to American species of section Percomes Brandr. & Melot

1. Odor very strong and unpleasant earthy or of green corn. Basidiomata rather robust species *C. superbus* A.H.Smith

1*. Odor more aromatic and spicy or of green apples **2**
2. Lamellae yellow or greenish yellow **3**
2*. Lamellae at first argillaceous. *C. cephalixoides* Mos. & Thiers
3. Lamellae lemon yellow when young. Odor sweetish aromatic, spicy, (majoram etc.) *C. percomis* Fr.
3*. Lamellae dingy greenish yellow . Habit of *C. superbus* *C. superbus var. aromaticus*

Note: If basidiomata have a more or less marginate bulb, check *C. guttatus* R. Hry. (Moser & Ammirati 1996)

Notes on *Cortinarius percomis* Fr.

This taxon, common in the Pacific states, is rather rare in the Greater Yellowstone Area in most years. It has been observed only three times in the years from 1983 to 1995. In 1997 it was rather common and was observed as large specimens, sometimes in fairy rings and in clusters of seven to eight specimen. Only a few samples have been collected, as it is otherwise a well known species. In collection IB 97/239 fruit-bodies with pilei from 45-90 mm and stipes from 40-90 x 20-40 mm were observed, growing in clusters.

Collections examined: IB 83/345, Northeast entrance to Yellowstone National Park, 23 Aug 1983, IB 97/217, Medine Bow Mts., Snowy Range, near origin of Barretts Creek, Wyo, leg. M. Moser, 19 Aug. 1997, 97/239, Southwest Brooks Lake Lodge, Shoshone Natl. Forest, leg. M. Moser, 23 Aug 1997. JFA11410 (WTU) Brooks Lake Lodge, Shoshone Natl. Forest, leg. J. Ammirati 27 Aug. 1995, MTS 4130 (WTU) Flagstaff Road, Teton Natl. Forest, 19 Aug. 1995, leg. M. T. Seidl and J. Ammirati, JFA 11431 (WTU), same location, 30 Aug. 1995, leg. J. Ammirati, MTS 4134 (WTU) Four Mile Meadow, Teton Natl. Forest, 31 Aug 1995, leg. M. T. Seidl.

First record of *Cortinarius superbus* A.H. Smith for Wyoming.

This striking robust and often large species with very strong disagreable earthy (green corn) odor was collected at Taggart Lake, Teton National Park, Wyo, coll. IB 97/147 on 9 August 1997. We have a number of records from Washington, Oregon, and California. This provoked a discussion, whether *C. russeoides* Mos. from Europe could be identical with *C. superbus*. Both species have the same very unpleasant, penetrating odor which can be perceived even from herbarium specimens and even plastic bags in which this fungi were kept for some time, retain the odor for several years. However, C.

russeoides is very common on calcareous soils in conifer forests of several parts of Europe, particularely in the Alps and the senior author has seen many thousends of basidiomata. There is a constant difference in size and habit of the basidiomata, which are slender in the European taxon (pileus 30-70 mm, stipe 40-100 mm long, 7-20(-25) mm thick, spores of coll.IB 51/179 9-12x5.5-7.5(-8) μm), whereas the American taxon is constantly rather robust and large (pileus 40-120 mm, stipe 45-130 x 25-30 mm). Colors and veil condition are similar as well as the spore size and shape. Spore measurements for *C. superbus* in Smith coll. 17680 : 12.3-14.1x6.9-7.9 μm, mean 13.1(S=0.5)x7.5(S=0.3) μm, Q=1.6-1.9, mean 1.7 (S=0.06), V=311-466 μm^3 , mean 391 μm^3. IB 91/655: 10.6-12.4x6.5-7.4 μm, mean 11.6(S=0.5)x7.1 (S=0.16) μm, Q=1.5-1.8, mean 1.65, V= 260-345 μm^3, mean 306 μm^3; IB 95/245: 10.9-13.5x6.5-7.7 μm, mean 12.1(S=0.6)x7.0 (S=0.28) μm, Q=1.5-1.8 , mean 1.7, V=258-414 μm^3, mean 313 (S=35) μm^3.

Collections examined: **Washington**: A.H. Smith 17680 (holotype, MICH) Olympic Hot Springs, Olympic Natl. Park, 8 Oct. 1941.; IB 95/245, Lake Angeles Trail, Olympic Natl. Park, 5 Oct. 1995, leg. M. Moser.- **Wyoming**: 97/147, Taggart Lake, Teton Natl. Park, 3 Aug. 1997, leg. M. Moser.- **California**: IB 91/655, Russian Gulch State Park, Mendocino, 5 Dec. 1991 leg. M. Moser,

From the Mt. Hood area in Oregon we collected a variety which had a green-corn odor only when freshly collected, but when cut or lying around for some time this odor disappeared and became a distinctly aromatic, sweetish odor, mixed fruity and of green apples or even slightly sweetish, spicy (of majoram).
The spores slightly larger, 10.6-15.6x5.9-7.7 μm, mean 12.3(S=1.2)x6.7(S=0.4), Q=1.6-2.2 , mean 1.8 , V=202-4.77 μm^3, mean 296 (S=61)μm^3 .

Collection examined: IB 95/370, Clear Creek Camp Ground , Mt. Hood area, Oregon, mixed conifer forest (*Abies lasiocarpa, A. grandis, Larix, Picea engelmannii, Tsuga, Pseudotsuga)* 25. Oct. 1995 leg. M. Moser

This above described taxon seems to deserves recognition as a form :

Cortinarius (Phlegmnacium) superbus **A.H.Smith forma** ***aromaticus*** **Mos. fm. nov.**

Differt a typo odore variabili, aromatico, fruticoso.
Holotypus IB 95/370, Clear Creek Camp Grd., Clallam.Co., Oregon, 25 Aug. 1995, leg. M. Moser

Comments: Melot (1987) synonymizes *Cortinarius nanceiensis* R. Mre. with *C. mussivus* (Fr.) Melot and regards *C. russeoides* Mos. as synonym of *C. mussivus* var. *sulphureus* (Lindgren) Melot. Brandrud et al. (1998)

synonymize *C. russeoides* with *mussivus*, but maintain *C. nanceiensis* as distinct taxon. We can not agree with either of this synonymies. Fries described *Agaricus (Hebeloma) mussivus* in Epicrisis (1838). This description contains several characters which can not be found in *C. russeoides*. These are "lamellis flavidis", "pileus flavus l. disco crustallino","caro flava","odor debilis not ingratus". In Monographia (1857) he calls the colors bright, the stipe very fleshy, 10 cm long, mostly 2.5 cm thick, yellow, ... veil fibrillose, very fugacious. The pileus 5-10 cm broad, dissolved in squamules or unicolorous yellow or disc darker brown, flesh yellow, gills at first yellow, flesh becoming yellow and again odor weak, not unpleasant. *Cortinarius russeoides* to the contrary has greenish, greenish yellow to olive-yellow and olive-brown colors in the lamellae and on the stipe. The pileus is never yellow, the veil is not fugacious but persistent and brownish to grayish violaceous and the odor is extremely unpleasant and strong and persists even in exsiccati for years. This all is in clear contradiction to the description of *Agaricus mussivus* Fr.

Cortinarius (Phlegmacium) cephalixoides Mos. & Thiers (1995)

This species was described in part I of this series (Moser, McKnight and Ammirati 1995). We assumed at that time, that the species would be related to the group which includes *C. cephalixus.* A new record, however, made it clear, that this taxon is very closely related to the European species *C. citrinoolivaceus* Mos. and we can not fully exclude this as the correct name. Both taxa seem to be very rare and thus it is difficult to judge the full range of variability. We provide a description of the new record below.

Pileus 40-50 mm diam., convex to obtusely conico-campanulate, glutinous, with yellow-brown colors, margin with more yellow, Caill 79M, toward the disc more brown, Caill 60P, and only very slightly and indistinctly innately fibrillose. **Lamellae** argillaceous, Tilleul Buff(R) or slightly darker, rounded adnate to emarginate, edges uneven to eroded, close to crowded, L= 100-105, l=1-3, 24-25/cm at margin, 3-5 mm wide (equalling 1-0.7x thickness of pileus context). **Stipe** 50-75 mm long, 15-16 mm thick above, 20-23 at the base, clavate, pale yellow, with yellow veil remains which can discolor with age and become slightly brownish.
Context whitish in pileus, yellow in stipe. Odor when cut strongly grassy or of green apples. Taste mild. **Chemical reactions**: KOH greenish on context and pileipellis. Under **UV** pileus and stipe red, gills

yellow, context in pileus partly bluish, in upper stipe yellow, in lower stipe reddish.

Microscopic characters: Basidiospores 10.9-13.7x6.7-8.1 μm, mean 12.6 (S=0.8) x 7.36 (S=0.34) μm, Q=1.5-1.86, mean 1.7 , V= 282-471 μm^3, mean 360 μm^3, almond-shaped, verrucose, apex more or less glabrous. Without cheilocystidia. Basidia 4-spored, clavate, subventricose, 38-44x9-10 μm, subhymenial hyphae 2-4, hyphae in lateral strata 4-7 μm, in mediostratum 11-14 μm, very pale yellowish, nearly colorless, clamp connections present. Pileipellis with gelatinous pellicle of 4-7 μm wide hyphae, rather irregular, clamp connections present, partly colorless, partly with olivaceous content. Epicuticular hyphae 6-8 μm, with pale to darker olivaceous content, hypocutis subcellular.

Habitat: under *Picea engelmannii, Abies lasiocarpa*, at "Calypso" Creek, Flagstaff Road, Teton National Forest,

Collections examined: **Wyoming**: IB 97/222 and JFA 12444 (WTU) leg. J. Ammirati, 21 Aug. 1997

We have one other record which belongs to this group but differs by having a smaller habit, a rather strong odor of green apples, and slightly narrower spores.

Pileus 70 mm diam, convex, margin already straight in young specimen, glutinous, brown with some olive tints, center darker, margin paler, margin near Clay Color (R), center near Sayal Brown (R) but with an olive cast, surface not innately fibrillose. **Lamellae** near Sayal Brown (R) but paler, not greenish or yellowish at first, crowded, L=100, l=1-3, about 15/ cm at margin, 6-7 mm broad (which equals thickness of pileus context), emarginate, edges uneven. **Stipe** 60 mm long, 18 mm thick, base 28 mm, greenish yellow, Sulphur Yellow (R). **Veil** yellowish ? (not visible in the collected specimen). **Context** whitish or pallid towards margin of pileus yellow in the center, deeper greenish yellow in stipe, between Caill 85L and 85M, in stipe base discoloring brownish to reddish brown, the surface of stipe base also slightly so. **Odor** rather strong of green apples, also slightly of fresh baked bread. **Chemical reactions**: KOH on context greenish, slowly olive-grey-brown on pileipellis. Under **UV** pileus red mixed with some dingy yellow, stipe purplish, apex bluish, context orange-yellow in stipe.

Microscopic characters: Basidiospores 12.2-15x6.5-7.4 μm, mean 13.5(S=0.6)x6.8(S=0.2) μm, Q=1.8-2,3, mean 2.0(S=0.09), V=268-425 μm^3, mean 332 (S=33) μm^3, slender almond-shaped, verrucose. Basidia 36-39(40) x9-9.5(-10) μm, 4-spored, clavate, subhymenial hyphae 4-5 μm, trama hyphae 6-12(-15) μm, in mediostratum up to 25 μm, colorless or very pale olivaceous, clamp connections present. Without cheilocystidia, Pileipellis with gelatinous layer with ascending to irregularly erect hyphae, 2.5-3.5(-4) μm, with olivaceous content, clamp connections present. Epicuticular hyphae 5-11 μm, nearly colorless or with pale olivaceous brown walls, easily separating from pileus trama.

Habitat: Under *Picea engelmannii*. IB 89/207 and JFA 9909 (WTU), Fourmile Meadow, Teton Natl. Forest, Wyoming, 11 Aug. 1989.

Comments: The yellow or greenish tints in the lamellae, the size of the spores, and the type of KOH reaction could indicate that this collection may also belong to *C. cephalixoides*. The spores are narrower, however. The locality of collection 97/222 is about 0.3-0.5 mile from the site of the collections from 1987. Collection 89/207 was found about 1.5 miles away on the northern side of the Blackrock Creek. In *C. citrinoolivaceus* Mos. the spores are of the same shape and size, 11.2-13.5x6.5-7.8 μm, mean 12.6(S=0.6)x7.2(S=0.3) μm, Q=1.6-1.9, mean 1.76, V=245-434 μm^3, mean 342(S=39) μm^3, almond-shaped and strongly verrucose. This agrees well with the collections from Flagstaff Rd. The colors of pileus, gills and stipe are similar, however, the color of the veil is brownish-violaceous in the European taxon.

8. Section Infracti Brandr. & Melot

Cortinarius (Phlegmacium) infractus Fr. var. flavus Mos. var. nov. (Fig.6(5), 8e)

Differt a typo coloribus pilei flavo-brunneis usque flavis, lamellarum pallidiore, olivaceo-brunneis, sapore leviter amariusculo, fere miti.
Habitatio in silvis coniferis subalpinis (*Picea engelmannii, Abies lasiocarpa).*
Holotypus IB 97/169, prope Brooks Lake Lodge, Shoshone Natl. Forest, Wyoming, 12 Aug. 1997 leg. M. Moser.

Since 1983 we have observed many times a fungus which clearly belongs to the *C. infractus* complex but certainly deserves the status of a variety.

Pileus 20-80 mm diam, convex, margin at first involute, glutinous, margin hygrophanous, color yellow-brown to almost yellow, (Caill 60M to N to 65M), marginal zone with olivaceous grayish color, (Caill 69N to 70N, 90M, 90N, 91N or also paler 89L, 90L or yellow 89K to 87L). **Lamellae** olivaceous brownish, (Caill 67N, 70P to 69N, 69P, Mu

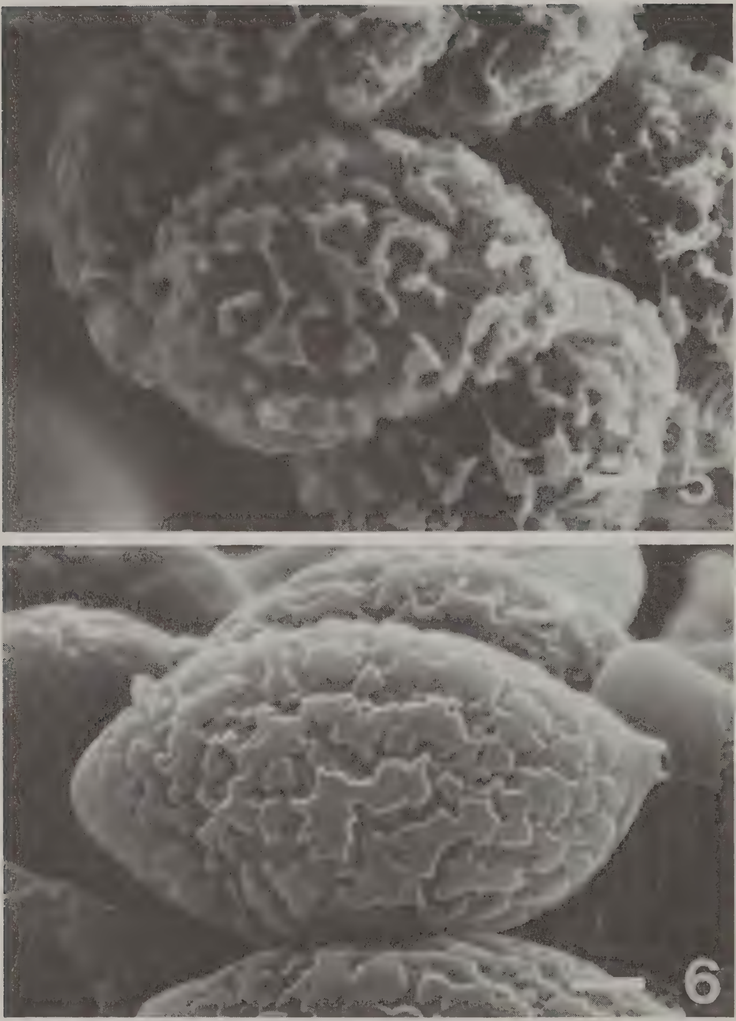

Fig. 6. Spores in SEM of : 5. *Cortinarius infractus* var. *flavus* (97/189). 6. *Cortinarius sannio* (97/352) (Bar = 1 μm)

10YR4/6), rounded adnate, edges eroded, paler, close to moderately crowded, L=(40)-100-120, l=1-3, 17-18/cm at margin, 4-8 mm wide, equal to about 1/2 to 1x thickness of pileus context. **Stipe** 25-70 mm long, 10-16 mm thick, the base 12-20 mm, equal or clavate, pale gray at first, below the cortina often with yellowish covering (veil remains ?), then grayish brown with an olivacous cast and innately fibrillose (darker and paler).

Veil whitish. **Context** Pale Olive Buff (R) to Tileul Buff (R), in stipe grayish marbled. **Odor** very slightly of cedar wood (?) or fungaceous, taste only very slightly bitter, nearly mild.

Chemical characters: KOH negative, NH_4OH negative on context and pileus surface, lugol brown, silver nitrate blackish. Under **UV** pileus dingy red with dingy yellow areas, stipe dingy red, context blue.

Microscopic characters: Basidiospores 6.7-8.5x4.8-6.1 (6.6) μm, mean 7.6(S=0.4)x5.4(S=0.2) μm, Q= 1.25-1.6, mean 1.4 (S=0.08), V= 86-161 μm^3, mean 118 (S=14) μm^3, drop-shaped to subglobose or subamygdaliform. Cheilocystidia absent, basidia clavate, 4-spored, 30-32x7.5-8 μm, subhymenial hyphae 2-3.5 μm, trama hyphae 5-7(-8), in mediostratum up to 12 μm, colorless to very pale yellowish gray, slightly encrusted, clamp connections present. Pileipellis with gelatinous pellicle, hyphae irregular, 2-3(-4) μm wide, pale yellowish, with clamp connections. Epicutis a thick layer of hyphae 5.5-8 μm, walls pale yellow, with clamp connections, in hypocutis up to 12 μm, walls paler yellowish, more irregular.

Habitat: in conifer forests under *Picea engelmannii, Abies lasiocarpa.*
Collections examined: IB 83/182, west of Teton Pass, Targhee Natl. Forest, 2 Aug. 1998, leg. M. Moser; IB 87/65, above Turpin Meadow, Teton Natl. Forest, 23 Jul. 1987 leg. M. Moser; IB 97/169, southwest of Brooks Lake Lodge, Shoshone Natl. Forest, Wyoming, leg. M. Moser 12 Aug. 1997, (holotype) - IB 97/265, same area 27 Aug. 1997

Comments: This variety differs from typical *C. infractus* by the yellowish colors of the pileus surface, the distinctly paler gills, and a very slightly bitterish, sometimes nearly mild taste. This variety is actually the common form in the whole Greater Yellowstone area, while the typical variety is relatively rare.

9. Cortinarius (Phlegmacium) sannio Mos. spec. nov.
ethymology: sannio = harlequin
(Fig.5(6), 7, 9e)

Pileo 55-75(-10) mm lato, convexo, margine primo involuto, disco mox applanato, glutinoso, coloribus mixtis, primo olivaceo-ochraceis, dein pallide ochraceis leviter olivaceo tincto praecipue marginem versus, disco magis olivaceo-brunneo, variegato vel innato fibrilloso, aetate olivaceo-brunneo vel in fundo bubalino brunneo innato-fibrilloso; lamellis primo pallide rosaceo-bubalinis, vinaceo-bubalinis, dein avellaneis, argillaceis, adnatis usque emarginatis, confertis, acie subserrulato, 5-10 mm latis; stipite 35-50 mm longo, 15-28 mm crasso, bulbo marginato 25-45 mm, primo pallide flavo, demum e velo violaceo, interdum solo in parte inferiore, bulbo infra violaceo, mycelio albido, cortina flavidula, velo universale violaceo, carne albida, odore grato condimenti; sporis 9.1-11.7x4.7-5.9 μm, amygdaliformibus usque sublimoniformibus, verrucosis, basidiis 30-35x7.5-9 μm, clavatis, tetrasporigeris, absque cheilocystidiis.
Habitatio; in silvis coniferis subalpinis (*Picea engelmannii, Abies lasiocarpa, Pinus albicaulis).* Holotypus IB 97/352, infra lacum dicto "Lost Lake", Teton Natl. Forst, Wyoming, U.S.A., 10 Sept. 1997, leg. M. Moser.

Pileus 55-75 (105) mm diam, convex, margin at first involute, but sometimes disc already applanate in young specimens, marginella remaining involute also in mature specimens, glutinous, colors rather mixed, in buttons margin olivaceous ocher, Caill 89K, later pallid, ochraceous with slight olivaceous cast particularely near margin, in old specimens retaining some of these colors but brown areas extending more to the margin, towards disc with olive-brown colors, Caill 87L, 77L, 77N, 65N 69P to 69R, finely marbled or innate fibrillose, and with some darker spots, Bister (R), in old specimens becoming pale olive-brown, Caill 77N and disc more brown, 57P, 59P, toward margin somewhat innate fibrillose, in age also occurring with Pinkish Buff (R) ground color and brown innate fibrils. **Lamellae** in young stages Pinkish Buff (R) to Vinaceous Buff (R), later Avellaneous (R), finally Clay Color (R), edges uneven to eroded, rounded adnate to emarginate, crowded, L=120-130, l= 1-3, 18-22/cm at margin, 5-10 mm wide, equal to thickness of pileus context or less. **Stipe** 35-50 mm long, 15-28 mm thick, the marginate bulb 25-45 mm, in young specimens pallid, Marguerite Yellow (R), later violet often up to the apex but often only in lower part and the violet color comes from the veil, Grayish Lavender (R), bulb underneath violet but basal mycelium white. Bulb margin sometimes becoming ochraceous. **Cortina** yellowish, universal **veil** violaceous. **Context** whitish, Pale Pinkish Buff (R). **Odor** weak but pleasant, somewhat spicy, taste mild. **Chemical reactions**: KOH negative or slightly brownish on context, darker brown on pileipellis. No reaction on violet parts. Under **UV** pileus dull yellow with dingy reddish areas, stipe bluish or partly yellow, gills bluish gray, context blue mixed with yellow areas.

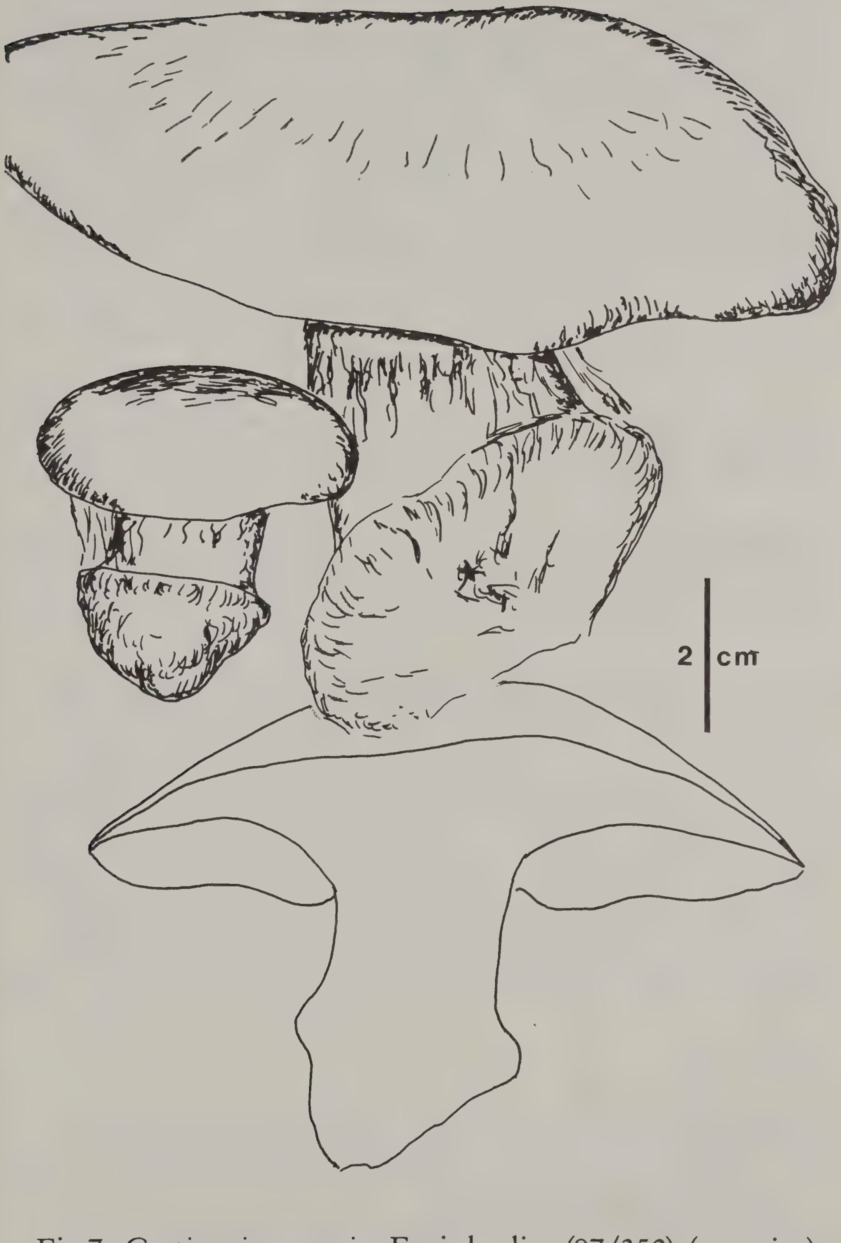

Fig.7. *Cortinarius sannio*. Fruit-bodies (97/352) (nat. size).

Microscopic characters: Spores almond-shaped to mostly sublimoniform, 9.1-11.7x 4.7-5.9 µm, mean 10.3 (S=0.5)x 5.5 (S=0.3) µm, verrucose, apex smooth, without cheilocystidia, basidia clavate, 4-spored, 30-35x7.5-9 µm, subhymenial hyphae 3-4 µm, trama hyphae 6-9 µm, in mediostratum up to 20 µm, colorless or walls very pale ochraceous, with clamp connections. Pileipellis with gelatinous pellicle of 2.5-5.5 µm wide hyphae, walls colorless to slightly ochraceous or yellowish, with clamp connections, subrepent to irregular, epicuticular hyphae 5.5-8 µm, walls yellow-brown, in hypocutis hyphae 10-15(16) µm, walls yellowish to yellowish brown, paler than in epicutis, segments moderately long, narrowed at septae.

Habitat. Subalpine conifer forests, with *Picea engelmannii, Abies lasiocarpa, Pinus albicaulis.*

Collections examined: IB 97/297, Lake east of Two Ocean Mtn, 2900m, Shoshone Natl. Forest, Wyoming, leg. M.Moser 31 Aug 1997; IB 97/352, below Lost Lake, Teton National Forest, leg. M. Moser, 10 Sept. 1997(holotype).

Comments: This species is particularly characterised by the mixture of different colors, the yellow cortina and violet universal veil. At present the relationship remains uncertain but we place it temporarily in section Callochroi.

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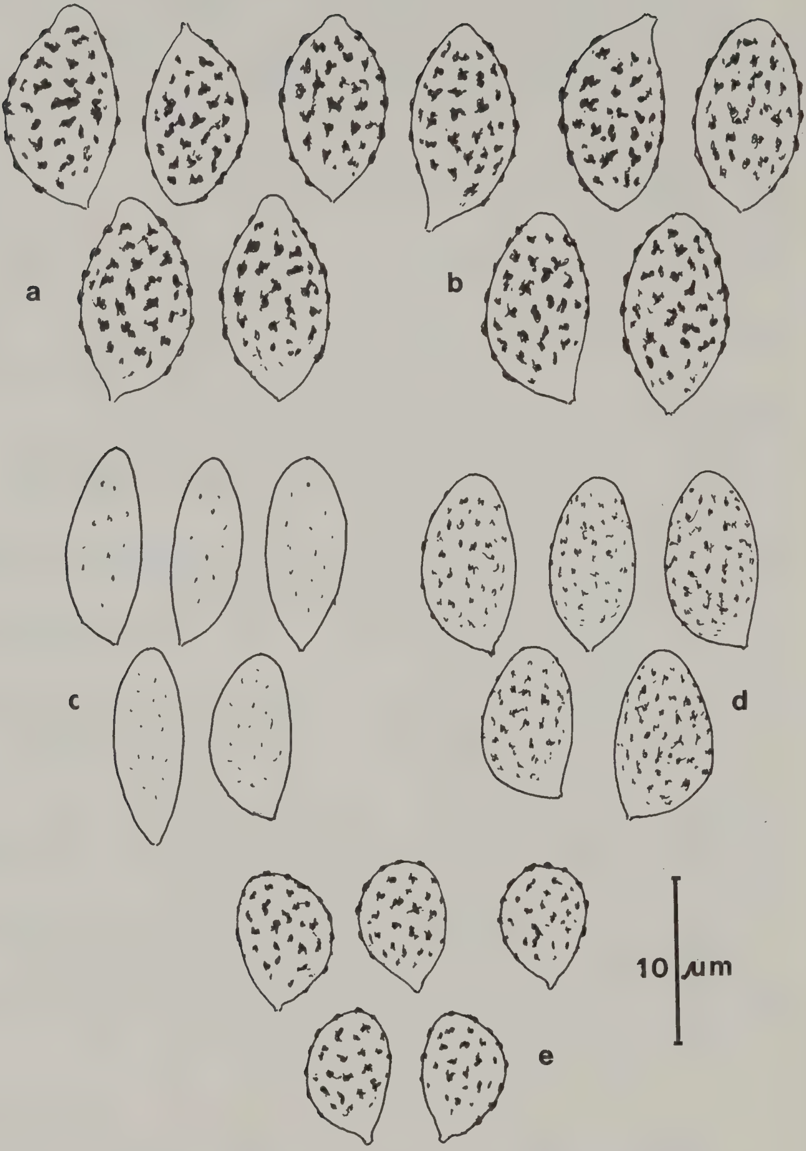

Fig.8. Basidiospores of :a. *Cortinarius calojanthinus* (97/220). b. *C.citriolens*(97/157). c.*C. pseudovariegatus* (97/296). d. *C. variosimilis* (89/493). e. *C. infractus* var. flavus (97/169). (x 2000).

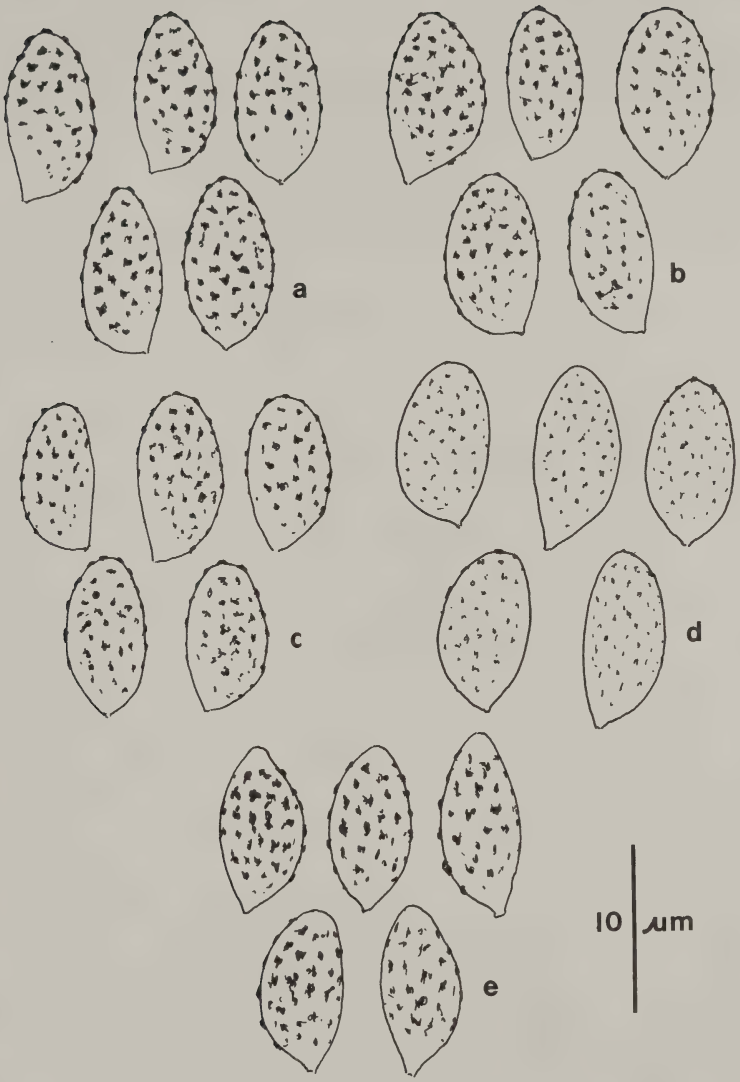

Fig. 9. Basidiospores of: a. *Cortinarius subfoetidus* var.*bubalinovelatus* (95/607). b.*C. subfoetidus* (holotype of Smith 17778). c. *C. subfoetidus* (97/458). d. *C. cephalixus* var. *aurantiobrunneus* (94/189). e. *C. sannio* (97/352) (x 2000)

MYCOTAXON

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FUNGAL FLORA OF TROPICAL GUANGXI, CHINA: INTRODUCTION[*]

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Very little work has been done on fungi from tropical Guangxi by Chinese mycologists. Our knowledge of fungi in the area is extremely limited. To explore the species diversity of fungi in tropical China, excursions were organized in Guangxi from the middle of December, 1997 to middle of January, 1998 by the Systematic Mycology and Lichenology Laboratory, Chinese Academy of Sciences. Forests in different regions were investigated, which are located to the north (Damingshan, Wuming), south (Shiwandashan Mountains, Shangsi including Dalongshan, Hongqi Forestry Station, Pinglongshan), and west (Defu Nature Reserve and Nonghua Nature Reserve, Napo) of Nanning, the capital city of the province. The collecting sites are at altitudes of 200-1300 m. Humidity was high in Mt. Damingshan but relatively dry in Mt. Shiwandashan and Napo County. Although it was not the best season for fungus hunting, about 2000 specimens of lichens, cup-fungi, polypores, hyphomycetes, rusts, smuts, agarics, slime molds and a few others were collected. Previous collections from tropical Guangxi on deposit in the Herbarium Mycologicum Instituti Microbiologici Academiae Sinicae (HMAS) were also scanned to learn of fungi occurring in other seasons.

Three papers have been finished based on studies of some collections from the areas (Zhuang, 1998, 1999; Guo, 1999). Further examinations and identifications were carried out in the past year and a series of 8 research papers are provided here to show our current understanding of fungi in tropical Guangxi, which are preliminary and based on a portion of the specimens obtained from the field excursions. Recently, 449 species of 175 genera belonging to 60 families were found, in which 18 new species, 3 new combinations, and 28 new Chinese records are included. We are expecting to discover more from detailed studies of unidentified material.

During our field work, assistance of the following institutions and people, that made this research possible, are deeply appreciated: Department of Nature

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广西热带菌物初探：引言

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广西热带真菌过去记载很少。1997 年和 1998 年交接之际，在国家林业局和广西省林业厅的协助下，我们在广西大明山自然保护区、上思县平广林场和红旗林场（十万大山）、那坡县德浮和弄化二自然保护区进行了野外考察，采集到地衣、盘菌、半知菌、多孔菌、锈菌、黑粉菌、伞菌、黏菌等标本约 2000 份。对部分标本进行研究结果表明，广西热带菌物物种丰富，初步鉴定出 60 科 175 属的各类菌物 449 种。其中包括新种 18 个，新组合 3 个，我国新记录 28 种。后面的连续 8 篇文章分别对各类群进行了详细报道。

MYCOTAXON

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FUNGAL FLORA OF TROPICAL GUANGXI, CHINA: DISCOMYCETES OF TROPICAL CHINA. IV MORE FUNGI FROM GUANGXI [*]

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ABSTRACT Sixteen discomycetes in four families from Guangxi Province, China are reported. *Encoelia dalongshanica*, *Lanzia guangxiensis*, *Lanzia sinensis*, *Phialina damingshanica*, *Polydesmia pteridicola*, and *Torrendiella guangxiensis* are new to science. New records of China are found in *Encoelia*, *Parachnopeziza*, *Pezicula*, and *Velutarina*.

Since the previous report of discomycetes from tropical Guangxi (Zhuang, 1998, 1999b), more fungi of the Hyaloscyphaceae, Sclerotiniaceae, Helotiaceae, and Dermateaceae from the same areas were examined. Among them, *Encoelia dalongshanica*, *Lanzia guangxiensis*, *Lanzia sinensis*, *Phialina damingshanica*, *Polydesmia pteridicola*, and *Torrendiella guangxiensis* are described as new species; *Encoelia* taxonomic sp., *Parachnopeziza bambusae*, *Pezicula cinnamomea*, and *Velutarina rufo-olivacea* are reported for the first time from China; and *Strossmayeria bakeriana* is currently found in the mainland of this country.

HYALOSCYPHACEAE

Parachnopeziza bambusae Arendholz & R. Sharma, Mycotaxon 20: 652, 1984. 竹近蛛盘菌

Apothecia gregarious to interconnected, thin and flat, broadly sessile, with long, white hairs extending to the margin, up to 1.1 mm in diam, hymenium cream white, receptacle white; hairs 800-900 µm long and 3 µm wide, cylindrical and slightly narrow at apex, with a blunt apex, hyaline, somewhat glassy, thick-walled, with a fine lumen, septate; ectal excipulum of textura porrecta, medullary excipulum of textura intricata; hymenium 150-160 µm thick; asci 8-spored, clavate, some with a long tail, J+, pore walls blue in Melzer's reagent, 137-175 x 12-14 µm; ascospores cylindrical at upper portion and tapered towards the lower end, rounded at upper apex, mostly 15-septate, multiguttulate, arranged in a fascicle in ascus, 70-92 x 2.5-3.0 µm; paraphyses filiform, more or less glassy, ca 1.5 µm wide.

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Specimens examined: on a small bamboo, Shiwandashan, Shangsi, alt. 400 m, W. P. Wu & W. Y. Zhuang 1986, 29 XII 1997, HMAS 74833; on a ?bamboo, Shiwandashan, Shangsi, alt. 300 m, W. P. Wu & W. Y. Zhuang 1952, 27 XII 1997, HMAS 74896.

Notes: Arendholz & Sharma (1984) provided a detailed description and illustrations of *Parachnopeziza bambusae* based on material from India. HMAS 74833 is somewhat different from the Indian collection in larger asci (137-175 x 12-14 µm *vs.* up to 145 x 9-11 µm), and both Chinese collections have narrower ascospores (70-92 x 2.5-3.0 µm *vs.* up to 105 x 4 µm) with 15-19 septa and longer hairs.

The fungus shares characteristics with both *Hyalopeziza* Fuckel and *Parachnopeziza* Korf (Raschle, 1977; Korf, 1978). It has very distinct, straight, thick-walled, long hairs. Some apothecia seated on a thin layer of whitish subiculum and attached broadly to the substrate. It is similar to *Parachnopeziza* in presence of a very thin layer of subiculum and to *Hyalopeziza* in hair morphology; but its hairs are extremely long, several in a fascicle, giving a spine-like look, and surround the apothecial margin when fresh.

Phialina damingshanica W. Y. Zhuang, **sp. nov.** 大明山隔毛小杯菌 (Fig. 1)

Ab *Phialinae* speciebus aliis differt apotheciis lignatilibus, ascosporis parvis, 3-4 x 0.6-0.7 µm, pilis 2-3-septatis, 32-62 x 2.0-2.5 µm.

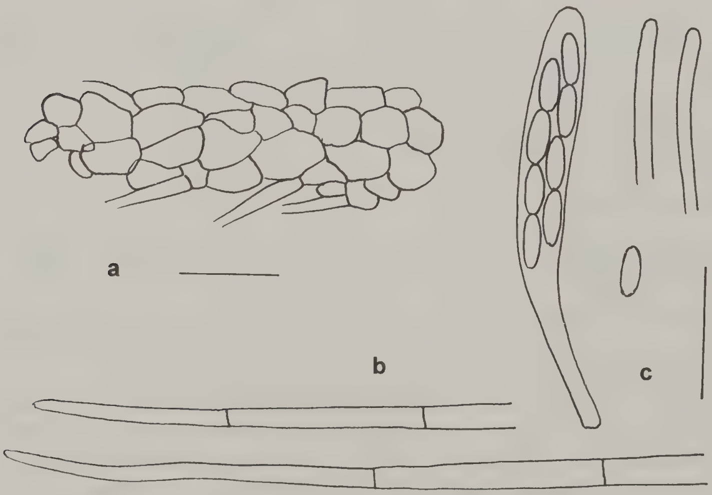

Fig. 1. *Phialina damingshanica* **a**. Ectal excipulum; **b**. Hairs; **c**. Ascus, ascospores and paraphysis apices. **a** scale = 20 µm, **b**, **c** scale = 10 µm. From holotype.

Apothecia discoid, very short-stipitate to subsessile, 0.2-0.5 mm in diam, hymenium light yellowish beige, receptacle lighter than hymenium, surface slightly hairy; hairs aciculate, tapered gradually towards the apex, 32-62 µm long, 2.5 µm wide at base and 1.0 µm wide at apex, mostly with 2-3 septa, wall smooth, thin, hyaline; ectal excipulum of textura prismatica at margin and textura angularis at flanks, 15-35 µm thick,

cells 5-10 x 3-6 µm and 6-13 µm in diam if isodiametric, walls thin and brown; medullary excipulum of textura intricata, ca 25 µm thick, hyphae hyaline, 1-2 µm wide; asci 8-spored, clavate, J+, pore walls blue in Melzer's reagent, 30-32 x 4 µm; ascospores ellipsoid, nonguttulate, biseriate, 3-4 x 0.6-0.7 µm; paraphyses filiform, ca 0.7 µm wide.

Holotype: on wet hard wood, Damingshan, Wuming, Guangxi, alt. 1300 m, W. Y. Zhuang 1882, 21 XII 1997, HMAS 74831.

Notes: According to Huhtinen (1990), *Hyaloscypha* Boud. is mostly on wood and with hairs non-septate, while *Phialina* Höhn. is on leaves and with septate hairs. The present fungus does not fit either genus but seems closer morphologically to *Phialina* than to *Hyaloscypha*. It is distinguished from the known species of *Phialina* in the nonguttulate and small ascospores, 3-4 x 0.6-0.7 µm; aciculate, 2-3-septate, straight hairs, 32-62 x 2.5 µm; and occurrence on wood instead of on leaves. In the genus *Phialina*, the spore shape of *Phialina damingshanica* is more or less similar to that of *Phialina foliicola* (Graddon) Huhtinen but different in hair shape and size of apothecia. *Phialina lachnobracha* (Desm.) Raitv. has similar hairs to the new species but does not match in other features.

Polydesmia pteridicola W. Y. Zhuang, **sp. nov.** 蕨叶多丝盘菌 (Fig. 2)

Ab *Polydesmia dumontii* apotheciis parvis, 0.1 mm diam; ascis late clavatis, brevibus, 35-40 x 8.0-8.5 µm; ascosporis subellipsoideis, biguttulatis vel triguttulatis, nonseptatis vel uniseptatis, 8.3-10.0 x 2.5-3.0 µm differt.

Apothecia discoid, sessile, 0.1 mm in diam, hymenium whitish, receptacle concolorous; hairs as short hyphal protrusions, present at and near margin, undulate to straight; ectal excipulum of textura angularis to textura prismatica, ca 10 µm thick, cells hyaline, thin-walled, 2-3 µm wide; medullary excipulum of textura intricata, ca 18 µm thick, hyphae hyaline, 1 µm wide; asci 8-spored, broadly clavate, J+, pore walls blue in Melzer's reagent, 35-40 x 8.0-8.5 µm; ascospores subellipsoid, with 2 to 3 guttules, 0-1-septate, irregularly uniseriate, 8.3-10.0 x 2.5-3.0 µm; paraphyses filiform, branched and slightly deformed at apex, 1.5-1.8 µm wide.

Holotype: on leaf spot of a fern, Damingshan, Wuming, Guangxi, China, alt. 900 m, J. Y. Zhuang & W. Y. Zhuang 1865, 20 XII 1997, HMAS 74832.

Notes: Among the 5 existing species of *Polydesmia* Boud. (Raitviir & Galan, 1995; Zhuang, 1999a), *Polydesmia dumontii* (Korf) Korf is the closest species to *Polydesmia pteridicola* in the genus. The former differs from the latter in asci 4-spored and 45-55 x 7.2-8.5 µm instead of 8-spored and 35-40 x 8-8.5 µm, larger ascospores with 1-3-septate instead of 0-1-septate, larger apothecia up to 0.4 mm in diam instead of 0.1 mm in diam. They both have pteridophyte host, the former is on rachis (Korf, 1978), whereas, the latter is on a leaf spot.

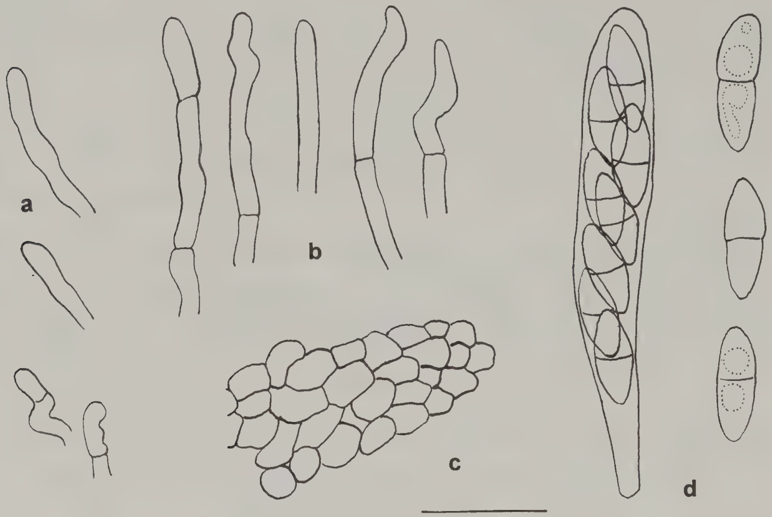

Fig. 2. *Polydesmia pteridicola* **a**. Short hyphal protrusions; **b**. Paraphysis apices; **c**. Ectal excipulum; **d**. Ascus and ascospores. Scale = 10 µm. From holotype.

SCLEROTINIACEAE

Dicephalospora rufocornea (Berk. & Broome) Spooner, Bibl. Mycol. 116: 272, 1987.

Specimen examined: on rotten twig, Pinlongshan, Shangsi, alt. 500 m, X. Q. Zhang & W. Y. Zhuang 2359, 2 I 1998, HMAS 74877.

Lanzia guangxiensis W. Y. Zhuang, **sp. nov.** 广西兰斯盘菌 (Fig. 3)

Ab *Lanzia griseliniae* apotheciis 0.3-1.5 mm diam, hymeniis pallidospadiceis; ascis latiusculis, 105-120 x 9-11 µm; ascosporis majusculis, 12.0-17.5 x 4.5-6.0 µm differt.

Apothecia discoid, stipitate, 0.3-1.5 mm in diam, hymenium semi-translucent to beige when fresh and light beige when rehydrated, receptacle semi-translucent to light brown when fresh and brownish when rehydrated, black at lower 2/3 of stipe; ectal excipulum of long-celled textura prismatica, 20-43 µm thick, cells very pale brown, 15-27 x 4-10 µm wide; medullary excipulum of textura intricata, 20-110 µm thick, hyphae hyaline, 1-2 µm wide; hymenium 115 µm thick; asci 8-spored, clavate, J+, pore walls blue in Melzer's reagent, 105-120 x 9-11 µm; ascospores subellipsoid, biguttulate, uniseriate, 12.0-17.5 x 4.5-6.0 µm; paraphyses filiform, 1.5 µm wide.

Holotype: on stromatized midvein of a leaf, Pinglongshan, Shangsi, Guangxi, China, alt. 500 m, W. P. Wu & W. Y. Zhuang 2365, 2 I 1998, HMAS 74834.

Other specimen examined: on leaf blade with line stromata, Damingshan, Wuming, alt. 1300 m, W. Y. Zhuang 1889, 27 XII 1997, HMAS 74835.

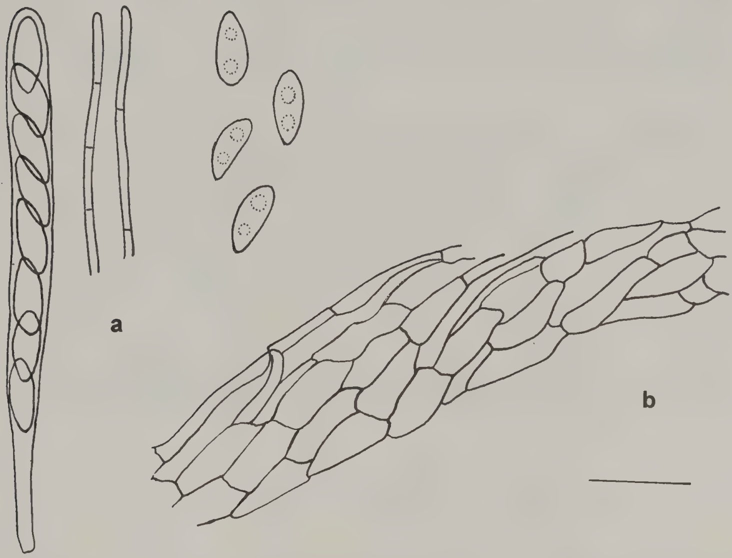

Fig. 3. *Lanzia guangxiensis* **a**. Ascus, ascospores and paraphysis apices; **b**. Ectal excipulum. Scale = 20 μm. From holotype.

Notes: *Lanzia guangxiensis* is similar to *Lanzia griseliniae* (Dennis) Dumont in spore shape and size but different from the latter in apothecia smaller, 0.3-1.5 mm in diam *vs*. 1.5-3.0 mm in diam; hymenium beige and somewhat translucent *vs*. purple brown; asci wider, 9-11 μm wide *vs*. 7.5-9.5 μm wide; and ascospores larger, 12.0-17.5 x 4.5-6.0 μm *vs*. 11.5-14.5 x 3.5-4.8 μm (Spooner, 1987).

HMAS 74834 collected from Pinglongshan on stromatized midvein of leaf has larger apothecia, ectal cells, and spores than HMAS 74835 from Damingshan on leaf blade.

Lanzia huangshanica W. Y. Zhuang & Korf forma **huangshanica**, Mycosystema 7: 13, 1995.

Specimens examined: on stromatized petioles of *Rhododendron* sp., Damingshan, Wuming, alt. 1300 m, W. Y. Zhuang 1878, 24 XII 1997, HMAS 74836; on petioles, Pinglongshan, Shangsi, 500 m, W. P. Wu, S. L. Chen & W. Y. Zhuang 2343, 2 I 1998, HMAS 74878.

Notes: This species was recorded previously on petioles of *Castanopsis* sp. from Huangshan, Anhui Province (Zhuang, 1995) and now is discovered on petioles of *Rhododendron* sp., which indicates that the fungus is not host-specific but petiole-inhabiting.

Lanzia sinensis W. Y. Zhuang, **sp. nov.** 中华兰斯盘菌 (Fig. 4)

Ab *Lanzia prasinia* apotheciis foliicolis, parvis, 0.3-0.5 mm diam, longistipitatis, hymeniis puniceo-aurantiacis, ascis 55-65 x 7.0-8.5 µm, ascosporis 7-11 x 3.5-4.0 µm differt.

Apothecia discoid, surface flat, long-stipitate, 0.2-0.6 mm in diam, hymenium beige to pinkish orange, receptacle semi-translucent, stipe base black; ectal excipulum of textura prismatica, ca 22-30 µm thick, cells subhyaline, 10-15 x 3-10 µm; medullary excipulum of textura intricata, 25-65 µm thick, hyphae hyaline, subhyaline to pale brown, 1.5-3 µm wide; hymenium 60-80 µm thick; asci 8-spored, clavate, J+, pore walls blue in Melzer's reagent, 51-75 x 6.5-8.0 µm; ascospores subellipsoid, biguttulate, irregularly uniseriate to irregularly biseriate, 7-11 x 3.5-4.0 µm; paraphyses cylindrical, slightly deformed and sometimes enlarged at apex, ca 1.5 µm wide.

Holotype: on rotten leaves, Pinglongshan, Shangsi, Guangxi, China, alt. 500 m, W. P. Wu, S. L. Chen & W. Y. Zhuang 2878, 2 I 1998, HMAS 74898.

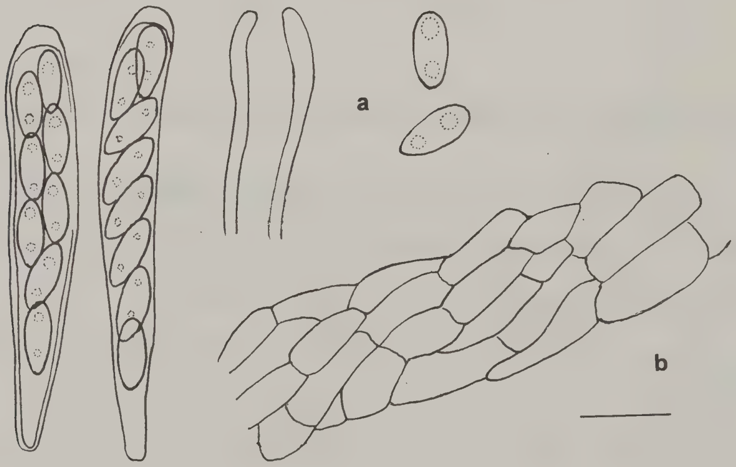

Fig. 4. *Lanzia sinensis* **a**. Asci, ascospores and paraphysis apices; **b**. Ectal excipulum. Scale = 10 µm. From holotype.

Paratypes: on rotten leaf of a tree, Defu Natural Reserve, Napo, alt. 1100 m, S. L. Chen & W. Y. Zhuang 2400, 10 I 1998, HMAS 74837; on rotten leaves, Pinglongshan, Shangsi, alt. 500 m, W. P. Wu, S. L. Chen & W. Y. Zhuang 2366, 2 I 1998, HMAS 74897.

Notes: This fungus is characterized by its small, beige to pinkish orange, and semitranslucent apothecia with a long and very dark stipe; and small, ellipsoid ascospores with two conspicuous guttules. It is similar to *Lanzia prasinum* (Massee) Spooner (1987) in spore size but different in aspects mentioned above as well as shorter and wider asci, wider ascospores, and occurrence on a leaf instead of wood.

Moellerodiscus lentus (Berk. & Broome) Dumont, Mycologia 68: 245, 1976.

Specimens examined: on inner bark of *Cunninghamia* sp., Damingshan, Wuming, alt. 1100 m, W. Y. Zhuang 1840, 19 XII 1997, HMAS 74838; on rotten bark of *Cunning-hamia* sp., Damingshan, Wuming, alt. 700 m, W. Y. Zhuang 1923, 23 XII 1997, HMAS 74839; on stromatized rotten wood, Damingshan, Wuming, alt. 1200 m, W. Y. Zhuang 1798, 18 XII 1998, HMAS 74879; on inner bark of *Cunninghamia* sp., Shiwandashan, Shangsi, alt. 240 m, W. Y. Zhuang 1977, 28 XII 1997, HMAS 74880.

Rutstroemia cf. **conformata** (P. Karst.) Nannf., Fungi Exsic. Suec. #1174, 1942.

Specimen examined: on leaf blade of a dicotyledonous plant, Damingshan, Wuming, alt. 1300 m, W. Y. Zhuang & W. P. Wu 1883, 21 XII 1997, HMAS 74840.

Notes: Ascospores of the Guangxi collection are narrower than *Rutstroemia conformata* reported by Dennis (1956). It has long-stipitate apothecia, 2.0-2.2 mm in diam, dirty vinaceous hymenium, brown receptacle, and a very dark stipe base; 8-spored, clavate, J+ asci, 105-110 x 8.5-9.5 µm; and biguttulate ascospores, 10.5-15 x 3.6-4.0 µm.

The species was previously recorded from Zhejiang and Guangdong provinces (Tai, 1979), but specimens are no longer available.

Torrendiella guangxiensis W. Y. Zhuang, **sp. nov.** 广西小托雷盘菌 (Fig. 5)

Ab *Torrendiella eucalypti* ascosporis majoribus, 20-28(-30) x 5.5-7.5(-8.0) µm, ascis grandibus, 120-140 x 13-15 µm, apotheciis parvis, 0.3-0.8 µm diam differt.

Apothecia discoid, surface flat, very short-stipitate, 0.3-0.8 mm in diam, hymenium gray, receptacle brown, with black setae on surface; setae not densely distributed, blackish brown, multiseptate, smooth-walled, up to 360 µm long; ectal excipulum of textura prismatica to textura porrecta, tissues gelatinous, 28-38(-45) µm thick, cells thick-walled, subhyaline to pale brown in outer layers, light brown in inner layers, mostly 11-18 x 2.5-5.0 µm; medullary excipulum of textura intricata, 30-120 µm thick, hyphae hyaline, thin-walled, 2-3.5 µm wide; hymenium 130-135 µm thick; asci 8-spored, clavate, J+, pore walls blue in Melzer's reagent, 120-140 x 13-15 µm; ascospores fusoid, with 3 guttules, biseriate, 20-28(-30) x 5.5-7.5(-8.0) µm; paraphyses subcylindrical, 2-2.5 µm wide.

Holotype: on leaves of a tree, Damingshan, Wuming, Guangxi, China, alt. 1300 m, W. Y. Zhuang & W. P. Wu 1885, 21 XII 1997, HMAS 74841.

Notes: Compared with species of *Torrendiella* Boud. & Torrend described by Spooner (1987), *Torrendiella guangxiensis* is close to *Torrendiella eucalypti* (Berk.) Spooner in spore shape but different in larger spores [20-28(-30) x 5.5-7.5(-8.0) μm *vs.* 15-20 x 3.5-4.5 μm], larger asci [120-140 x 13-15 μm *vs.* (80-)86-95(-104) x 7-9 μm], and smaller apothecia (0.3-0.8 mm *vs.* 0.5-1.5 mm in diam).

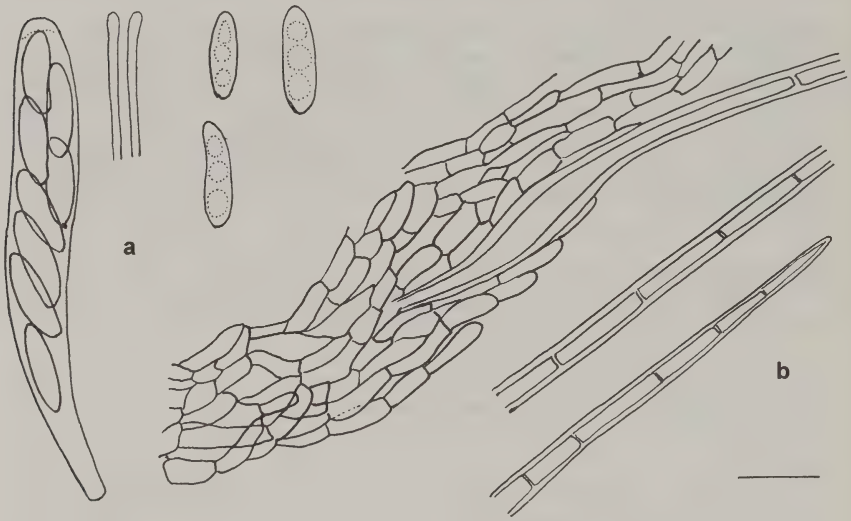

Fig. 5. *Torrendiella guangxiensis* **a**. Ascus, ascospores and paraphysis apices; **b**. Ectal excipulum with a seta. Scale = 20 μm. From holotype.

HELOTIACEAE

Encoelia dalongshanica W. Y. Zhuang, **sp. nov.** 大龙山散胞盘菌 (Fig. 6)

Ab *Encoelia helvola* ascosporis subellipsoideis, biguttulatis, 10-13 x 3-4 μm, apotheciis parvis, ad 1 mm diam differt.

Apothecia shallow cupulate, sessile, less than 1 mm in diam, hymenium cream, receptacle brown, surface furfuraceous; ectal excipulum of textura globulosa, with low pustules on surface, 20-50 μm thick excluding pustules, cells subglobose, 5-19 μm in diam, brown-walled in outer cells and hyaline in the inner ones, cells in outer layers forming short moniliform protrusions; medullary excipulum of textura intricata, 30-70 μm thick, hyphae hyaline, 1.5-2.0 μm wide; hymenium 95-100 μm thick; asci 8-spored, clavate, J+, pore walls strongly blue in Melzer's reagent, 75-87 x 8-10 μm; ascospores subellipsoid, one end narrower than the other, unicellular, with a nuclear stained area when mounted in cotton blue solution and two large guttules, irregularly uniseriate to irregularly biseriate, 10-13 x 3-4 µm; paraphyses cylindrical, 1.5-2.0 µm wide.

Holotype: on a small bamboo, Dalongshan, Shangsi, Guangxi, China, alt. 280 m, W. P. Wu & W. Y. Zhuang 2331, 1 I 1998, HMAS 74842.

Notes: Compared with *Encoelia helvola* (Jungh.) Overeem (Overeem & Weese, 1926) on living bamboo and those species of *Encoelia* (Fr.) P. Karst. recorded by Dennis (1978) and by Arendholz & Sharma (1984), *Encoelia dalongshanica* has subellipsoid ascospores which have two large guttules and are 10-13 x 3-4 µm instead of allantoid or elongate-ellipsoid in *Encoelia helvola*. It differs from *Encoelia himalayensis* Arendholz & R. Sharma (1984), the closest species in the genus, in smaller apothecia, shorter and wider asci, shorter ascospores, and presence of moniliform cells in outer layers of ectal excipulum. *Encoelia dalongshanica* has similar outer ectal excipular cells to *Encoelia urceolata* (Durand) W. Y. Zhuang (1988) but different ascospore size (10-13 x 3-4 µm *vs.* 7.5-8 x 2.5-2.8 µm), apothecial size (less than 1 mm in diam when fresh *vs.* 1-1.8 mm in diam when dry), and substrate.

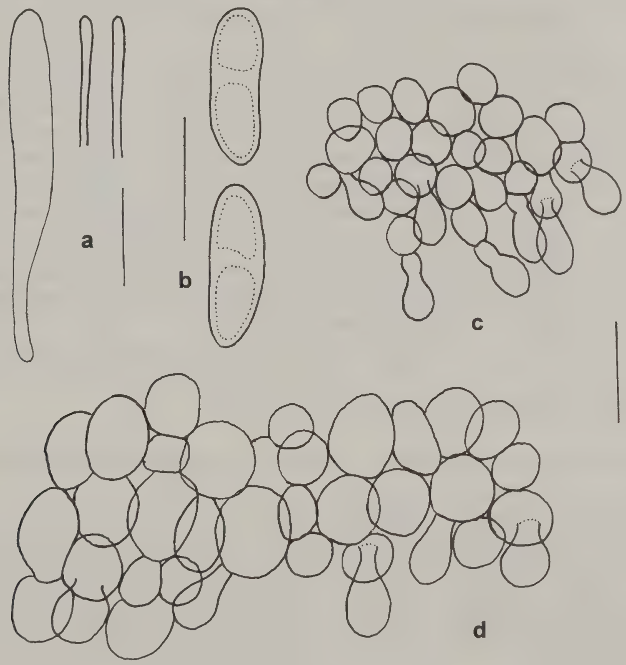

Fig. 6. *Encoelia dalongshanica* **a**. Ascus and paraphysis apices; **b**. Ascospores; **c**. Ectal excipulum near margin **d**. Ectal excipulum at base. **a**, **c**, **d** scale = 20 µm, **b** scale = 10 µm. From holotype.

Encoelia taxonomic sp.

Apothecia discoid, stipitate, surface convex, 0.4-0.7 mm in diam, hymenium pure white, receptacle white, surface furfuraceous to downy; ectal excipulum of textura angularis, 10-15 μm thick, cells loosely attached, more or less isodiametric, hyaline, 1.5-2.0 μm in diam; medullary excipulum not clearly distinguished from ectal excipulum, of textura intricata to textura angularis, 25-50 μm thick, hyphae hyaline, 1-2 μm wide; hymenium 43-45 μm thick; asci 8-spored, narrowly clavate, J+, pore walls blue in Melzer's reagent, 45-52 x 3 μm; ascospores ellipsoid, with two small polar guttules, irregularly uniseriate to irregularly biseriate, 5-6 x 1-1.5 μm; paraphyses filiform, 1-1.2 μm wide.

Specimen examined: on rotten leaf, Damingshan, Wuming, alt. 1300 m, W. Y. Zhuang 1881, 21 XII 1997, HMAS 74844.

Notes: This is certainly a rare fungus and tentatively treated here as a member of *Encoelia*. The outermost cell layers are loosely attached and cells are so tiny that structure is not clearly detected. The material is very scanty, containing only 5 apothecia, and is not good as a type.

Hymenoscyphus eburneus (Roberge) W. Phillips, Brit. Discom. p. 145, 1887.

Specimen examined: on stem of a graminaceous plant, Damingshan, Wuming, alt. 1200 m, W. Y. Zhuang & W. P. Wu 1918, 22 XII 1997, HMAS 74845.

Strossmayeria bakeriana (Henn.) Iturr., Mycotaxon 36: 408, 1990.贝克斯特罗盘菌

Apothecia pulvinate, sessile, 0.15-0.2 mm in diam, hymenium grayish white, receptacle concolorous; ectal excipulum of textura oblita, hyphae with gelatinized walls, consisting of long-celled hyphae; medullary excipulum of textura intricata; asci 8-spored, clavate, J-, pore walls not blue in Melzer's reagent, mostly 95-103 x 14-15 μm; ascospores clavate with one end narrow, becoming light blue in Melzer's reagent, multiguttulate, irregularly 2- to 3-seriate, 32.5-45 x 4.5-5.0 μm; paraphyses subcylindrical and very slightly enlarged at apex, 2-2.5 μm wide. Anamorph *Pseudospiropes*.

Specimen examined: on small bamboo, Damingshan, Wuming, alt. 1300 m, W. Y. Zhuang & W. P. Wu 1884, 22 XII 1997, HMAS 74846.

Notes: This is the first time that a species of *Strossmayeria* Schulzer is reported from the mainland of China. It was previously reported on a palm by Taylor (1997) from Hong Kong Special Administrative Region.

Velutarina rufo-olivacea (Alb. & Schwein. : Fr.) Korf, Phytologia 21: 207, 1971. 丝绒盘菌

Apothecia flat, sessile, margin crenate to dentate, 0.7-1.7 mm in diam, hymenium grayish beige when fresh and dark brown when dry, receptacle light brown when dry, surface furfuraceous; ectal excipulum of textura globulosa, mixed with loosely interwoven hyphae, 112-150 μm thick, cells subglobose, 4-13 μm in diam, thin-walled, subhyaline, contents highly refractive, some of outer cells ovoid and easily detached; medullary excipulum of textura intricata, 25-37 μm thick, hyphae pale brown, ca 2 μm wide; hymenium ca 137 μm thick; asci 8-spored, subcylindrical, J- when first mounted in Melzer's reagent, J+ and apex faintly blue when more

Melzer's reagent is added some time later, 117-132 x 10-12 μm; ascospores broadly ellipsoid to ovoid, hyaline and smooth-walled when young, becoming brown and rough-walled when fully mature, with one or two large guttules, uniseriate, 12-15 x 6.5-8.0 μm; paraphyses slightly swollen and with brown contents at apex.

Specimen examined: on twigs with bark, Shiwandashan, Shangsi, alt. 300 m, W. Y. Zhuang 1955, 27 XII 1997, HMAS 74843.

Notes: The genus *Velutarina* Korf was established to accommodate a single species *Velutarina rufo-olivacea* (Korf, 1971, 1973). Type materials of *Peziza rufo-olivacea* Alb. & Schwein. and its synonyms, *Peziza fraxinicola* Berk. & Broome and *Cenangium phaeosporum* Cooke, from the Royal Botanic Gardens, Kew, England were borrowed and compared. Morphology of the Chinese collection is identical with that of the type specimen of *Velutarina rufo-olivacea* which is not fully mature, and especially with morphology of *Peziza fraxinicola* Cooke. Dennis (1956) provided a detailed description and drawings of the fungus.

DERMATEACEAE

Pezicula cinnamomea (DC.) Sacc., Michelia 2: 332, 1881. 樟无柄盘菌

Apothecia pulvinate, surface convex, long-stipitate, 0.2-0.3 mm in diam, hymenium light orange, receptacle concolorous; ectal excipulum of textura angularis, 18-37 μm thick, cells angular, hyaline, thin-walled, 3-10 μm wide; medullary excipulum of textura intricata, 12-30 μm thick, hyphae hyaline; hymenium 122 μm thick; asci 8-spored, clavate, J- in Melzer's reagent without KOH pretreatment, J+ with KOH pretreatment, 95-122 x 17.5-20 μm; ascospores elongate-ellipsoid, multiguttulate, biseriate, 25-30 x 7.5-10.0 μm; paraphyses slightly enlarged at apex, 2.5-3 μm wide at apex and 1.2 μm wide below.

Specimen examined: on twigs, Damingshan, Wuming, alt. 1200 m, W. P. Wu & W. Y. Zhuang 1902, 22 XII 1997, HMAS 74848.

Notes: By consulting Dennis' (1974) key to British species of *Pezicula* Tul. & C. Tul., the closest species to the Damingshan collection (HMAS 74848) is *Pezicula cinnamomea*, especially the shape and size of asci and ascospores. The host of the Chinese collection was not recorded.

AKNOWLEDGEMENTS

The author would like to express her deep thanks to Mr. Jian-wei Chen, Director, Department of Nature Reserve, Forestry Bureau of China and Mr. Zi-min Liu and Mr. Zhi-hong Xu of Guangxi Forestry Department, for their kind arrangements for collecting in nature reserves of Guangxi; to Prof. R. P. Korf of Cornell University, USA for consultation and kindly serving as pre-submission reviewer of this paper; to Dr. B. M. Spooner and staff members of the Royal Botanic Gardens, Kew, England for sending *Velutarina* specimens on loan; to Dr. Wen-ping Wu of Novo Nordisk China, Drs. Shuang-lin Chen and Jian-ying Zhuang of this

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中国热带盘菌初探之四：广西记录增补

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在广西热带晶杯菌科真菌研究基础上，本文对该地区已知盘菌物种做了补充，报道晶杯菌科、核盘菌科、柔膜菌科和皮盘菌科真菌 16 种。其中，大龙山散胞盘菌 *Encoelia dalongshanica*，广西兰斯盘菌 *Lanzia guangxiensis*，中华兰斯盘菌 *Lanzia sinensis*，大明山隔毛小杯菌 *Phialina damingshanica*，蕨叶多丝盘菌 *Polydesmia pteridicola* 和广西小托雷盘菌 *Torrendiella guangxiensis* 为新种。散胞盘菌属一种 *Encoelia* taxonomic sp.，竹近蛛盘菌 *Parachnopeziza bambusae*，樟无柄盘菌 *Pezicula cinnamomea* 和丝绒盘菌 *Velutarina rufo-olivacea* 为中国新记录种。

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FUNGAL FLORA OF TROPICAL GUANGXI, CHINA: THE LICHEN FAMILY CLADONIACEAE[*]

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ABSTRACT Thirty-nine taxa of the family Cladoniaceae (lichen-forming fungi) belonging to the genera *Cladia*, *Cladonia* and *Thysanothecium* are reported from the tropical region of Guangxi, China. *Cladonia diversa*, *C. libefera*, *C. magyarica*, *C. melanocaulis*, *C. subsquamosa* are reported as new to China. 28 taxa are new to Guangxi. The aromatic compounds of each taxon were identified with thin-layer chromatography. The paper includes geographical elements and distribution in China of each species.

According to an unpublished flora of Cladoniaceae in China edited by Wei Jiangchun et al. there are about 106 species of Cladoniaceae (lichen-forming Ascomycotina) in China. They belong to the genera *Cladia* (1 species), *Cladina* (9 species), *Cladonia* (94 species), *Gymnoderma* (1 species) and *Thysanothecium* (1 species). Among them 13 species are reported from Guangxi. Other early records about Cladoniaceae from Guangxi include Sandstede (1932) reporting two species, *Cladonia dehiscens* and *Gymnoderma coccocapum*, and Wei et al. (1985) reporting *Cladia aggregata* respectively. This study is primarily based on 280 specimens of fresh material collected in tropical region of Guangxi, chiefly by the author in 1997-1998 and by Mr. Chen Linhai in 1998. Material studied is deposited in HMAS-L (Hebarium Mycologicum, Academia Sinica, Lichen Section).

The species were determined by their morphological and chemical characters. The chemical analyses were performed from acetone extracts by thin-layer chromatography (TLC) according to standardized procedures (Culberson 1972; White & James, 1985); solvent C was mainly adopted. The major aromatic compounds are usually listed under each taxon. The biogeographical analysis using the concept of Ahti (1978), Thomson (1967, 1984) and Yoshimura (1968) is given.

My taxonomy and nomenclature essentially follow the Names in Current Use List by Ahti (1993).

List of species and selected specimens

1. **Cladia aggregata** (Sw.) Nyl., Recogn. Ram. 1870, p.69(167) (1870).

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Chemistry:Barbatic acid and two unknown compounds.
Distribution in China: Anhui, Fujian, Guangxi, Guizhou, Hunan, Jiangxi, Sichuan, Taiwan, Xianggang, Xizang, Yunnan, Zhejiang.
Total distribution: Asia, Oceania, Australia, New Zealand, Africa, Middle America, South America.
Geographical element: Subantarctic to tropical.

2. Cladonia bacillaris Genth, Fl. Nassau: 406 (1835).
Chemistry: Barbatic, 4-o- demathylbarbatic and usnic acids.
Distribution in China: Anhui, Fujian, Guangxi, Guizhou, Heilongjiang, Hubei, Hunan, Jiangxi, Neimenggu, Shaanxi, Sichuan, Taiwan, Xizang, Yunnan.
Geographical element: Circumpolar (Boreal to tropical).

3. Cladonia bellidiflora (Ach.) Schaer., Lich. Helv. Spic.:21 (1823).
Chemistry: Squamatic and usnic acids.
Distribution in China: Guangxi, Taiwan.
Geographical element: Circumpolar (Arctic to temperatural).

4. Cladonia cervicornis (Ach.) Flot. subsp. **verticillata** (Hoffm.) Ahti, Lichenologist 12:126 (1980).
Chemistry: Fumarprotocetraric and protocetraric acids.
Distribution in China: Fujian, Guangxi, Guizhou, Neimenggu, Shaanxi, Shandong, Taiwan, Xizang, Yunnan.
Geographical element: Circumpolar (Arctic to temperatural).

5. Cladonia chlorophaea (Flörke ex Sommerf.) Spreng. em. Asahina, Syst. Veg. **4**(1):273 (1827).
Chemistry: Fumarprotocetraric and protocetraric acids.
Distribution in China: Anhui, Fujian, Guangxi, Guizhou, Hebei, Heilongjiang, Hubei, Jiangxi, Jilin, Neimenggu, Shaanxi, Sichuan, Taiwan, Xinjiang, Xizang, Yunnan, Zhejiang.
Geographical element: Cosmopolitan.

6. Cladonia corniculata Ahti & Kashiw. in May. Inoue, Stud. Cryptog. S. Chile: 136 (1984).
Chemistry: Fumarprotocetraric acid and Cph-2.
Distribution in China: Guangxi, Hainan, Sichuan.
Geographical element: Pantropical.

7. Cladonia cornuta (L.) Hoffm., Descr. Pl. Cl. Crypt.: t. **25**(1) (1794).
Chemistry: Fumarprotocetraric acid.
Distribution in China: Anhui, Guangxi, Heilongjiang, Jilin, Neimenggu, Shaanxi, Shandong, Sichuan, Taiwan, Xizang, Yunnan.

Geographical element: Cosmopolitan.

8. Cladonia dehiscens Vain., Nouv. Arch. Mus. Hist. Nat., ser. 3, **10**:271 (1898).
Chemistry: Posoromic acid.
Distribution in China: Guangxi, Hainan.
Geographical element: East Asian (Pantropical).

***9. Cladonia diversa** Asperges, Cladon. Sect. Coccif. Belg. **2**:364 (1983).
Chemistry: Usnic acid and zeorin.
Specimens examined: **Guangxi**, Damingshan Mount, 1200 M, Guo1243; Napo, Guo 1815. **Hunan**, Hengshan Mount, 1000 M, Zhao & Xu 9933. **Neimenggu**, Keyouqianqi, 1250 M, Gao 824. **Yunnan**, Deqin, Baimang Mount, 4230 M, Su 5747.
This species grows on soil or rotten wood.
Distribution in China: Guangxi, Hunan, Neimenggu, Yunnan.
Geographical element: Eurasian (Temperatural).
New to China.

10. Cladonia fenestralis Nuno, J. Jap. Bot. **50**:291 (1975).
Chemistry: Fumarprotocetraric and protocetraric acids.
Distribution in China: Anhui, Guangxi, Guizhou, Hubei, Jilin, Neimenggu, Shaanxi, Sichuan, Taiwan, Xizang, Yunnan.
Geographical element: East Asian (Temperatural).

11. Cladonia fimbriata (L.) Fr., Lichenogr. Eur. Reform.:222 (1831).
Chemistry: Fumarprotocetraric and protocetraric acids.
Distribution in China: Guangxi, Hebei, Heilongjiang, Hubei, Jilin, Neimenggu, Xinjiang, Yunnan.
Geographical element: Cosmopolitan.

12. Cladonia floerkeana (Fr.) Flörke, De Cladon.:99 (1828).

Chemistry: Barbatic acid or barbatic and thamnolic acids.
Distribution in China: Anhui, Fujian, Guangxi, Guizhou, Heilongiang, Hubei, Hunan, Jiangxi, Jilin, Sichuan, Taiwan, Xizang, Yunnan.
Geographical element: Circumpolar (Boreal to temperatural).

13. Cladonia fruticulosa Kremp., Verh. K.K. Zool.-Bot. Ges. Wien 30, Abh.:331 (1881).
Chemistry: Fumarprotocetraric acid; Psoromic acid; Fumarprotocetraric and homsekikaic acids.
Distribution in China: Anhui, Guangxi, Hainan, Hubei, Hunan, Jiangsu, Taiwan, Xianggang, Xizang, Yunnan, Zhejiang.
Geographical element: Pantropical.

14. Cladonia groenlandica (Å.E. Dahl) Trass, Folia Cryptog. Estonica **1**:2 (1972).
Chemistry: Fumarprotocetraric acid.
Distribution in China: Guangxi, Taiwan, Xizang.
Geographical element: Circumpolar (Arctic to boreal).

15. Cladonia gymnopoda Vain., Acta Soc. Fauna Fl. Fenn. **10**:172 (1894).
Chemistry: Fumarprotocetraric acid.
Distribution in China: Guangxi, Taiwan, Yunnan.
Geographical element: East Asian (Pantropical).

***16. Cladonia libifera** Savicz, Novosti Sist. Nizs. Rast. :167 (1965).
Chemistry: Fumarprotocetraric acid.
Specimens examined: **Guangxi**, Napo, 1000 M, Guo 1849. **Shaanxi**, Taibai Mount, Chen & He (no collecting number).
This species grows on soil.
Distribution in China: Guangxi, Shaanxi..
Geographical element: East Asian (Boreal to temperatural).
New to China.

***17. Cladonia magyarica** Vain., Fl. Hung. Exsicc. No. 715 [label] (1927).
Chemistry: Fumarprotocetraric acid and atranorin.
Specimens examined: **Guangxi**, Napo, 1000 M, Chen 98087. **Xingjiang**, Tianshan Mount, 2600 M, Wang 0984b.
This species grows on ground.
Distribution in China: Guangxi, Xinjiang.
Geographical element: Eurasian (Temperatural).
New to China.

18. Cladonia macilenta Hoffm., Deutschl. Fl. **2**:126 (1796).
Chemistry: Thamnolic and barbatic acids.
Distribution in China: Guangxi, Guizhou, Hainan, Hubei, Jilin, Neimenggu, Taiwan, Yunnan.
Geographical element: Circumpolar (Boreal to tropical).

19. Cladonia macrophylla (Schaer.) Stenh., Lich. Suec. Exsicc., ed.2, No. 186[label] (1865).
Chemistry: Psoromic acid.
Distribution in China: Guangxi, Shandong, Xizang, Yunnan.
Geographical element: Circumpolar (Arctic to boreal).

20. Cladonia maxima (Asahina) Ahti, Ann. Bot, Fenn. **15**:12 (1978).
Chemistry: Fumarprotocetraric acid.
Distribution in China: Guangxi, Jilin, Neimenggu.
Geographical element: Circumpolar (Boreal to temperatural).

***21. Cladonia melanocaulis** S.Stenroos, Ann. Bot. Fenn. 25:138 (1988).

Chemistry: Fumarprotocetraric acid and Cph-2.

Specimens examined: **Guangxi**, Shiwandashan Mount, 300 M, Guo 1417; Napo, 1000 M, Guo 1792.

This species is very close to *C. corniculata* Ahti & Kashiw. which is also found in the present study area. However the latter species is entirely sorediate and totally ascyphose. This species is terricolous in study area.

Distribution in China: Guangxi.

Geographical element: East Asian (Pantropical).

New to China.

22. Cladonia mongolica Ahti, Nova Hedwigia **44**: 196 (1987).

Chemistry: Fumarprotocetraric and protocetraric acids.

Distribution in China: Guangxi, Hainan, Heilongjiang, Hubei, Sichuan, Xizang, Yunnan.

Geographical element: East Asian (Temperatural to tropical).

23. Cladonia ochrochlora Flörke, De Cladon.:75 (1828).

Chemistry: Fumarprotocetraric and protocetraric acids.

Distribution in China: Beijing, Guangxi, Guizhou, Hainan, Heilongjiang, Hubei, Hunan, Jilin, Neimenggu, Shaanxi, Sichuan, Taiwan, Xinjiang, Xizang, Yunnan.

Geographical element: Cosmopolitan.

24. Cladonia peziziformis (With.) Laundon, Lichenologist **16**:223 (1984).

Chemistry: Fumarprotocetraric and ursolic acids or only fumarprotocetraric acid.

Distribution in China: Guangxi, Jiangsu, Sichuan, Xizang, Yunnan.

Geographical element: Circumpolar (Boreal to tempretural).

25. Cladonia phyllophora Ehrh. ex Hoffm., Deutschl. Fl. **2**:123 (1796).

Chemistry: Fumarprotocetraric acid.

Distribution in China: Anhui, Guangxi, Shaanxi, Xizang, Yunnan, Zhejiang.

Geographical element: Cosmopolitan.

26. Cladonia pocillum (Ach.) O.J.Rich., Pl. Crypt. Saone-et-loire:82 (1863).

Chemistry: Fumarprotocetraric and protocetraric acids.

Distribution in China: Guangxi, Heilongjiang, Hubei, Jilin, Neimenggu, Shandong, Sichuan, Xinjiang, Xizang, Yunnan.

Geographical element: Cosmopolitan.

27. Cladonia pyxidata (L.) Hoffm., Deutschl. Fl. **2**:121 (1796).

Chemistry: Fumarprotocetraric and protocetraric acids.

Distribution in China: Anhui, Beijing, Fujian, Guangxi, Hebei, Heolongjiang, Hubei, Hunan, Jiangxi, Jilin, Liaoning, Neimenggu, Shaanxi, Shandong, Shanghai, Sichuan, Taiwan, Xinjiang, Xizang, Yunnan.
Geographical element: Cosmopolitan.

28. Cladonia ramulosa (With.) Laundon, Lichenologist **16**:225 (1984).
Chemistry: Fumarprotocetraric and homosekikaic acids or fumarprotocetraric acid and Cph-2.
Distribution in China: Anhui, Fujian, Guangxi, Hainan, Hebei, Heilongjiang, Hubei, Jiangsu, Jilin, Liaolin, Neimenggu, Shaanxi, Shandong, Shanghai, Sichuan, Taiwan, Xianggang, Xizang, Yunnan, Zhejiang.
Geographical element: Pantropical.

29. Cladonia rappii A.Evans, Trans. Connecticut Acad. Arts **38**:297 (1952).
Chemistry: Fumarprotocetraric acid.
Distribution in China: Anhui, Fujian, Guangxi, Hainan, Jiangsu, Neimenggu, Taiwan, Xianggang, Xizang, Yunnan, Zhejiang.
Geographical element: Pantropical.

30. Cladonia rei Schaer., Lich. Helv. Spic.:34 (1823).
Chemistry: Fumarprotocetraric and homosekikaic acids.
Distribution in China: Anhui, Guangxi, Heilongjiang, Hubei, Jilin, Neimenggu, Shandong, Sichuan, Taiwan, Xizang, Yunnan, Zhejiang.
Geographical element: Circumpolar (Boreal to temperatural).

31. Cladonia sobolescens Nyl. ex Vain., Acta Soc. Fauna Fl. Fenn. **53**(1):80 (1922).
Chemistry: Fumarprotocetraric acid.
Distribution in China: Guangxi, Shandong, Sichuan, Xizang, Yunnan.
Geographical element: East Asian – North American (Temperatural).

32. Cladonia squamosa (Scop.) Hoffm., Deutschl. Fl. **2**:125 (1796).
Chemistry: Squamatic acid.
Distribution in China: Anhui, Guizhou, Hubei, Shaanxi, Taiwan, Xizang, Yunnan, Zhejiang.
Geographical element: Cosmopolitan.

33. Cladonia squamosa var. **subsquamosa** (Nyl. ex Leight.) Vain., Meddeland. Soc. Fauna Fl. Fenn. 6:113 (1881).
Chemistry: Thamnolic acid.
Specimens examined:**Guangxi**, Damingshan Mount, 1200 M, Guo 1444, 1448.
It grows over soil on rock.
Distribution in China: Guangxi, Neimenggu, Taiwan.
Geographical element: Circumpolar (Arctic to temperatural).

34. Cladonia strepsilis (Ach.) Grognot, Pl. Crypt. Saone-et-Loire:85 (1863).
Chemistry: Baeomycesic acid and strepsilin.
Distribution in China: Anhui, Fujian, Guangxi, Heilongjiang, Jiangxi, Yunnan.
Geographical element: Circumpolar (Boreal to temperatural).

35. Cladonia submultiformis Asahina, J. Jap. Bot. **18**:624 (1942).
Chemistry: Fumarprotocetraric and homsekikaic acids.
Distribution in China: Guangxi, Hainan, Taiwan.
Geographical element: East Asian (Pantropical).

36. Cladonia subradiata (Vain.) Sandst., Abh. Naturwiss. Vereine Bremen **25**:230 (1922).
Chemistry: Fumarprotocetraric acid.
Distribution in China: Anhui, Guangxi, Heilongjiang, Hubei, Hunan, Jilin, Sichuan, Xizang, Yunnan.
Geographical element: Pantropical.

***37. Cladonia subsquamosa** Kremp., Vidensk. Meddel. Naturhist. Foren. Kjobenhavn **5**:366 (1874).
Chemistry: Fumarprotocetraric acid and Cph-2.
Specimens examined: **Guangxi**, Napo, 1000 M, Chen 98330. **Xizang**, Bomi, 2910 M, Zong & Liao 322 (in Wei & Jiang, 1986, as *C. pitytea* = *C. ramulosa*)
This species grows on soil with moss over rock.
Distribution in China: Guangxi, Xizang.
Geographical element: Pantropical.
New to China.

38. Cladonia symphycarpa (Flörke) Fr., Sched. Crit. Lich. Suec. **8-9**:20 (1826).

Chemistry: Norstictic acid and atranorin.
Distribution in China: Guangxi, Sichuan, Yunnan.
Geographical element: Circumpolar (Arctic to tempretural).

39. Thysanothecium scutellatum (Fr.) D.J.Galloway, Nova Hedwigia **36**:390 (1982).
Chemistry: Usnic, divaricatic acids and two unknown substances (trace).
This is a corticolous species and it only grows on the bark of *Pinus massoniana* Lamb. in the study area.
Distribution in China: Guangxi, Hainan.
Total distribution: Asia, Australia, New Zealand.
Geographical element: Pantropical.

Discussion

The Tropical Guangxi flora of Cladoniaceae turned out to be rich. This may be due to the presence of a good tropical rain forest. The biogeographical analysis of all species found in the study area yielded 6 geographical elements, ie. Circumpolar (13, 33.3%), Cosmopolitan (10, 25.6%), Pantropical (7, 18%), East Asian (6, 15.4%), Eurasian (2, 5.1%) and East Asian – North American (1,2.6%). Among the species belong to Circumpolar and East Asian elements, eight species show obviously tropical features. In total there are 15 species (38%) with the tropical characters in the study area. The genus *Cladina* and the section *Unciales* in *Cladonia* are not found in tropical Guangxi. Their optimal distribution is in the high latitude and high altitude regions. The occurrence of the genus *Gymnoderma* in Guangxi is possible, but, it should be confirmed. There are still a few unexplored areas in the tropical Guangxi, so that my conclusions are only preliminary.

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中国广西热带地区的石蕊科地衣

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摘要 本文报道了中国广西热带地区的石蕊科地衣 39 个分类单位，分属于筛蕊属 (*Cladia*)、石蕊属 (*Cladonia*) 和扇盘衣属 (*Thysanothecium*)。其中狭杯红石蕊 (*Cladonia diversa*)、立柄石蕊 (*C. libefera*)、类麸石蕊 (*C. magyarica*)、黑茎石蕊 (*C. melanocaulis*) 和亚鳞片石蕊 (*C. subsquamosa*) 为中国新记录；28 个分类单位为广西新分布。文中附有每个分类单位所含的主要次生代谢产物、所属的地理成分及其在中国的分布。

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FUNGAL FLORA OF TROPICAL GUANGXI, CHINA: HYPHOMYCETES I.*

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Fifty-two species of Hyphomycetes from tropical areas of Guangxi Province are reported. Included are 3 new species: *Pseudocercospora euryae* Y. L. Guo on *Eurya groffii* Merr., *P. juglandicola* Y. L. Guo on *Juglans* sp. and *P. tephanicola* Y. L. Guo on *Stephania* sp.; 3 new combinations: *Pseudocercospora artanthes* (P. Henn.) Y. L. Guo on *Piper longum* L., *P. bougainvilleae* (Rao) Y. L. Guo on *Bougainvillea spectabilis* Willd. and *P.* d*idymochetonis* (Wakef.) Y. L.Guo on *Cipadessa cinerascens* (Pall.) Hand.-Mazz.; and 2 new records for China: *Mycovellosiella malloti* Kharwar, P. N. Singh & R. K. Chaudhary on *Mallotus* sp. and *Pseudocercospora oxysporae* (Kar & Mandal) Deighton on *Oxyspora paniculata* DC. Latin diagnoses, descriptions and illustrations of the new species are given. The specimens examined are deposited in HMAS.

Alternaria brassicae (Berk.) Sacc. , Michelia 2:129, 1880.
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On *Raphanus sativus* L.: Shangsi (HMAS 76353).

Alternaria brassicicola (Schwein.) Wiltshire, Mycol. Pap. 20: 8, 1947.
On *Raphanus sativus* L.: Shangsi (HMAS 76354).

Cercospora alangii Y. L. Guo, Mycosystema 5:109, 1992.
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On *Shuteria involucrata* (Wall.) W. W. Wight & S. Arn.: Napo (HMAS 76356).

Cercosporidium henningsii (Allesch.) Deighton, in M. B. Ellis, More Dematiaceous Hyphomycetes. p. 395, 1976.
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Distocercospora pachyderma (Syd. & P. Syd.) N. Pons & B. Sutton, Mycol. Pap. 160:60, 1988.
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Drechslera maydis (Nishik.) Subram. & B. L. Jain, Curr. Sci. 35:354, 1966.

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Exserohilum turcicum (Pass.) K. J. Leonard & Suggs, Mycologia 66:291, 1974.
On *Zea mays* L. : Debao (HMAS 36752), Ningming (HMAS 25257).

Miuraea persicae (Sacc.) Hara, Byogaich-Hoten (Manual of Pests and Diseases): 224, 1948.
On *Prunus persic*e (L.) Batsch.: Ningming (HMAS 25252).

Mycovellosiella koepkei (W. Kruger) Deighton, Mycol. Pap. 144:20, 1979.
On S*accharum officinarum* L.: Ningming (HMAS 40624).

Mycovellosiella malloti Kharwar, P. N. Singh & P. K. Chaudhary, Mycol. Res. 100:689, 1996.
On *Mallotus* sp.: Napo (HMAS 76357).

Mycovellosiella malloti was originally described on *Mallotus philippinensis* (Lam.) Muell.-Arg. in Nepal, the external hyphae 1.5~4.5μm wide; conidiophores 0~1-septate, 2.5~15.5 × 1.5~4.5μm; conidia 1~4-septate, 12~73 × 2~5μm. The collection on *Mallotus* sp. from China is very similar to the original description, but different only in the conidiophores slightly longer (2~26 × 3~4 μm), conidia slightly narrower (17~65 × 3~4 μm).

Passalora circumscissa (Sacc.) U. Braun , Mycotaxon 55:230, 1995.
On *Prunus persica* (L.) Batsch: Nanning (HMAS 55850, 55851, 55853,)
On *Prunus* sp.: Ningming (HMAS 55852).

Passalora personata (Berk. & M. A. Curtis) Shakil A. Khan & M. Kamal, Bakistan J. Sci. Res. 13:188, 1961.
On *Arachis hypogaea* L.: Nanning (HMAS 40666, 40667), Ningming (HMAS 40663, 40664), Rongxian (HMAS 15011).

Phaeoramularia dioscoreae (Ellis & G. W. Mart.) Deighton, in M. B. Ellis, More Dematiaceous Hyphomycetes. p.319. 1976.
On *Dioscorea bulbifera* L.: Pingguo (HMAS 42405).
On *Dioscorea japonica* Thunb.: Ningming (HMAS 42404).

Phaeoramularia rhois (A. Castellani) Deighton, in M. B. Ellis, More Dematiaceous Hyphomycetes. P. 317, 1976.
On *Rhus chinensis* Mill.: Pingxiang (HMAS 42421).

Pseudocercospora ageratoides (Ellis & Everh.) Y. L. Guo, Acta Mycol. Sinica 12:271, 1993.
On *Eupatorium japonicum* Thunb.: Rongxian (HMAS 14894).

Pseudocercospora aleuritidis (T. Miyake) Deighton, Mycol. Pap. 140:138, 1976.
On *Aleurites montana* (Lour.) Wils.: Shangsi (HMAS 76358).

Pseudocercospora artanthes (Henn.) Y. L.Guo, comb. nov.
Cercospora artanthes Henn., Hedwigia 48:18, 1909.
On *Piper longum* L.: Shangsi (HMAS 76359).

The collection from China has conidiophores olivaceous brown, branched, slightly geniculate, denticulate, 0~3-septate, 8.6~65 × 4.3~5.4μm; conidia narrowly obclavate to cylindrical, pale olivaceous, 3~8-septate, 25~97 × 2.5~4μm. It is very similar to Hennings's description (conidiophores 20~60 × 4~5μm, conidia 40~100 × 2~3.5μm).

Pseudocercospora atromarginalis (G. F. Atk.) Deighton, Mycol. Pap. 140:139, 1976.
On *Solanum nigrum* L. : Qinzhou (HMAS 55804).

Pseudocercospora boehmeriigena U. Braun, Cercosporoid Fungi from Russia and Adjacent Countries. p.42, 1997.
On *Boehmeria* sp.: Pingxiang (HMAS 55810).

Pseudocercospora bougainvilleae (V. G. Rao) Y. L. Guo, comb. nov.
Cercospora bougainvilleae V. G. Rao, Indian Phytopath. 15:112, 1962.
On *Bougainvillea spectabilis* Willd.: Nanning (HMAS 76360).

The collection from China has secondary mycelium external; stromata up to 55 μm diam,; conidiophores pale olivaceous, 0~2-septate, 6.5~45 × 3.2~4.5μm; conidia obclavate, subhyaline, 3~5-septate, 25~50 × 2.7~3.5μm. The conidiophores are shorter and slightly narrower than information given by Rao (54~169 × 3.6~5.4μm).

Pseudocercospora chengtuensis (F. L. Tai) Deighton, Mycol. Pap. 140:141, 1976.
On *Lycium chinense* Mill.: Nanning (HMAS 55828).

Pseudocercospora cinnamomi (Sawada & S. Kats.) T. K. Goh & W. H. Hsieh, Trans. Mycol. Soc. R.O.C. 2:135, 1987.
On *Cinnamomum cassia* Presl: Shangsi (HMAS 59003).

Pseudocercospora cylindrata (Chupp & Linder) N. Pons & B. Sutton, Mycol. Pap. 160:27, 1988.
On *Dioscorea* sp.: Rongxian (HMAS 15007).

Pseudocercospora didymochetonis (Wakef.) Y. L. Guo, comb. nov.
Cercospora didymochetonis Wakef., Kew Bull. Misc. Information 1931(4):205, 1931.
On *Cipadessa cinerascens* (Pell.) Hand.-Mazz.: Shangsi (HMAS 76361).

This collection has conidiophores 6.5~47.5 × 3~6μm; conidia olivaceous, 65~130 × 4~6.5μm. The conidia are longer and wider than Wakefield's decription (30~70 × 3~5μm).

Cercospora cipadessae Govindu & Thirum. (1954) on *Cipadessa bacifera* differs from this fungus by its shorter and narrower conidia (28.5~90 × 2.4~4.2μm).

Pseudocercospora eriobotryae (Enjoji) T. K. Goh & W. H. Hsieh, Trans. Mycol. Soc. R.O.C. 2:135, 1987.
On *Eriobotrya joponica* (Thunb.) Lindl.: Nanning (HMAS 55876, 55878), Jingxi (HMAS 55879), Napo (HMAS 76362).

Pseudocercospora eupatorii-formosani J. M. Yen ex Y. L. Guo & W. H. Hsieh, The

Genus *Pseudocercospora* in China. p.67, 1995.

On *Eupatorium odoratum* L.: Ningming (HMAS 55895).

Pseudocercospora euryae Y. L. Guo, sp. nov. Fig.1

Maculae amphigenae, suborbiculares vel orbiculares, 1.5~6 mm diam., rubro-brunneae. Caespituli hypogeni. Mycelium secundarium superficiale: hyphae pallide olivaceo-brunneae vel olivaceo-brunneae, ramosae, septatae, 2.5~ 3.2 μm latae. Stromata nulla vel parva, atro-brunnea. Conidiophora singularia vel 3~20 fasciculata, pallide olivaceo-brunnea vel medice brunnea, erect vel curvata, ramosa, geniculata, 1~12-septata, aliquantum constricta, 22~130 × 4.3~6.5μm. Conidia obclavata vel obclavato-cylindrica, subhyalina, ercta vel leviter curvata, ad apicem obtusa, ad basin obconico-truncata, 1~5-septata, plerumque 1~3-septata, 24~54 (~65) × 4.3~5.4μm.

Hab. in foliis vivis *Euryae groffii* Merr. (Theaceae): Napo, Guangxi Provincia, 12 I 1998, leg. Y. L. Guo, no.233 (HMAS 76363, Holotypus), no.234 (HMAS 76364).

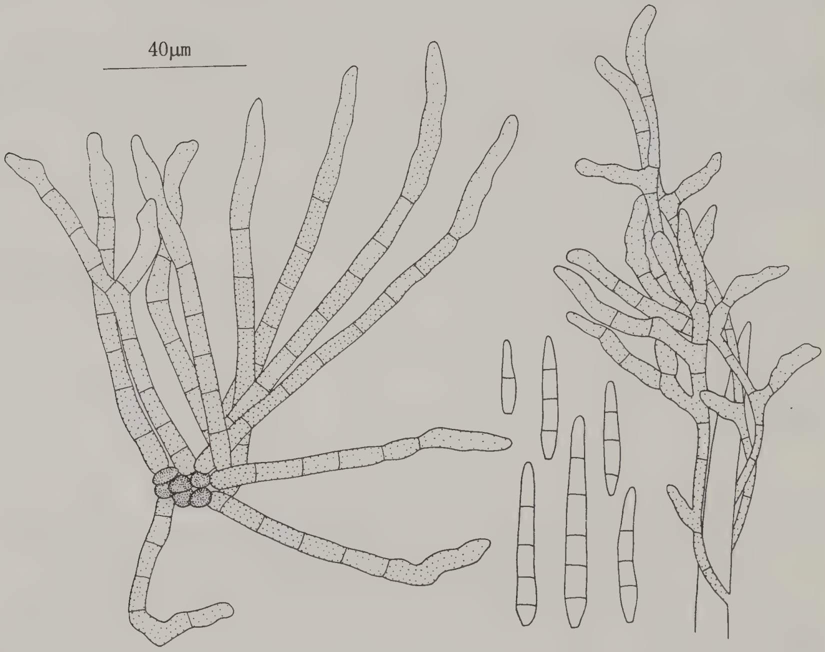

Fig.1 *Pseudocercospora euryae*

Leaf spots amphigenous, subcircular to circular, 1.5~6 mm diam., sometimes confluent, reddish brown, margin surounded by a dark brown to blackish line, with pale yellowish brown halo on the upper surface, pale brown on the lower surface. Fruiting hypogenous. Primary mycelium internal. Secondary mycelium external: hyphae emerging through the stomata or the base of fascicles, pale olivaceous brown to olivaceous brown, branched, septate, often climbing over the leaf hairs, 2.5~3.2μm wide. Stromata none or small, dark brown. Conidiophores 3~20 fasciculate or singly arising from the external mycelial hyphae, primary conidiphores moderately brown, secondary conidiophores pale to moderately olivaceous brown, paler towards the apex, irregular in width, straight to curved, branched, geniculate, sometimes denticulate, conical, conically truncate to rounded at the apex, 1~12-septate, sometimes constricted, 22~130 × 4.3~6.5μm. Conidia obclavate to obclavate-cylindrical, subhyline, straight to slightly curved, apex obtuse, base obconically truncate, 1~5-septate, mostly 1~3-septate, 24~54 (~65) × 4.3~5.4μm.

Cercospora caloloma Petrak (1950) on *Eurya nervosa* Bl. is similar to this fungus. It differs from the new species by its absence of secondary mycelial hyphae, larger stromata (60~100μm diam.), and subhyaline to pale olivaceous brown, longer and wider conidia (25~100 × 5~7.5μm).

Pseudocercospora evodiicola (Boedijn) P. K. Chi, Fungal Diseases of Cultiveted Medicinal Plants in Guangdong Province. P.142, 1994.

On *Evodia lepta* (Spreng.) Merr.: Shangsi (HMAS 76365).

Pseudocercospora fukuii (W. Yamam.) W. H. Hsieh & T. K. Goh, Trans. Mycol. Soc. R.O.C. 2:115, 1987.

On *Boehmeria nivea* (L.) Gand. : Nanning (HMAS 62743).

Pseudocercospora juglandicola Y. L. Guo, sp. nov. Fig.2

Maculae amphigenae, suborbiculares vel irregulares, 2~8 mm diam., rubro-brunneae. Caespituli hypogeni. Mycelium secundarium superficiale: hyphae pallide olivaceae, ramosae, septatae, 2.2~3.2μm latae. Stromata nulla vel parva, substomata, atro-brunnea. Conidiophora singulariter ex hyphis mycelii secundarii oriunda, laxe vel dense fasciculata, olivaceo-brunnea, erecta vel curvata, ramosa, geniculata, denticulata, 2~7-septata, 25~125 × 4.3~5.5μm. Conidia cylindrica, obclavata vel clavata, pallide vel olivaceo-brunnea, erecta vel curvata, ad apicem rotundata vel late rotundata, ad basin obconico-truncata, arte 3~11-septata, 22~60 × 4.3~6.7μm.

Hab. in foliis vivis *Juglansis* sp. (Juglandaceae): Napo, Guangxi Provincia, 10 I 1998, leg. Y. L. Guo, no.185 (HMAS 76366, Holotypus).

Leaf spots amphigenous, subcircular to irregular, 2~8 mm diam., center reddish brown, margin dark brown on the upper surface, pale brown on the lower surface. Fruiting hypogenous. Secondary mycelium external: hyphae pale olivaceous, branched, septate, 2.2~3.2μm wide. Stromata none or small, substomatal, dark brown. Conidiophores a few emerging through the stomata, loosely to densely fasciculate or arising as lateral branches from the external mycelial hyphae, olivaceous brown, uniform in color, irregular in width, straight to curved, branched, geniculate, denticulate, rounded to conically truncate at the apex, 2~7-septate, 25~125 × 4.3~5.5μm. Conidia cylindrical, shorter ones obclavate or clavate, pale olivaceous brown to olivaceous brown, straight to curved, apex rounded to broadly rounded, base obconically truncate, closely 3~11-septate, sometimes constricted, 22~60 × 4.3~6.7μm.

Pseudocercospora platycaryae T. K. Goh & W. H. Hsieh (1989) and *Pseudocercospora pterocaryae* Y. L. Guo & W. X. Chao (1989) on Juglandaceae are different from this fungus. In *Pseudocercospora platycaryae* conidiophores are pale olivaceous and narrower (2.5~3.5 μm wide). In *Pseudocercospora pterocaryae* conidiophores are shorter and narrower (10~70 × 3~4μm), conidia are very pale olivaceous, mostly obclavate, longer and narrower (35~100 × 3~4 μm).

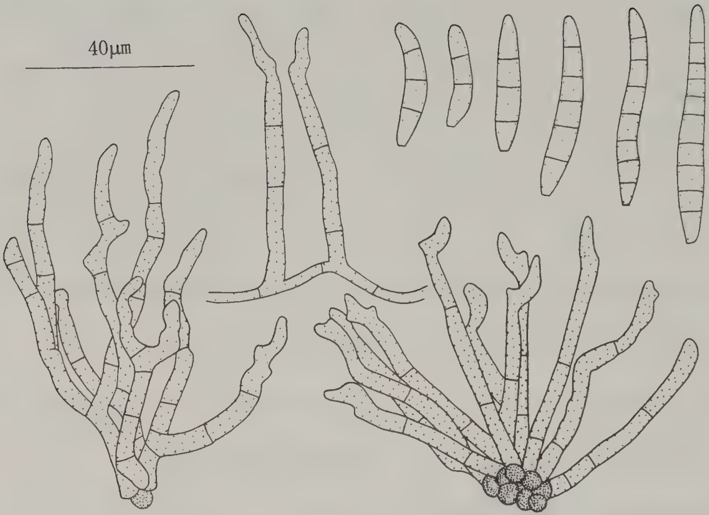

Fig.2 *Pseudocercospora juglandicola*

Pseudocercospora kaki T. K. Goh & W. H. Hsieh, *Cercospora* and Similar Fungi from Taiwan. P.109.

On *Diospyros* sp.: Ningming (HMAS 31523).

Pseudocercospora liquidambaris Sawada ex T. K. Goh & W. H. Hsieh, *Cercospora* and Similar Fungi from Taiwan. p.150, 1990.

On *Liquidambar formosana* Hance: Shangsi (HMAS 59085, 59086).

Pseudocercospora macarangae (Syd. & P. Syd.) Deighton, Mycol. Pap. 140:47, 1976.

On *Macaranga denticulata* (Bl.) Muell.-Arg.: Shangsi (HMAS 76367).

Pseudocercospora mali (Ellis & Everh.) Deighton, Mycol. Pap. 140:147, 1976.

On *Pyrus serrulata* Rehd.: Ningming (HMAS 59109).

Pseudocercospora malloticola T. K. Goh & W. H. Hsieh, *Cercospora* and Similar Fungi from Taiwan. p.124,1990.

On *Mallotus paniculata* (Lam.) Muell.-Arg.: Shangsi (HMAS 76368).

Pseudocercospora musae (Zimm.) Deighton, Mycol. Pap. 140:148, 1976.

On *Musa basjoo* Sieb. & Zucc.: Ningming (HMAS 59124, 59125).

Pseudocercospora oxysporae (A. K. Kar & M. Mandal) Deighton, Trans. Br. Mycol. Soc. 88:388, 1987.

On *Oxyspora paniculata* DC.: Napo (HMAS 76369).

Cercospora oxysporae A. K. Kar & M. Mandal has conidiophores pale to moderately olivaceous, 0~6-septate, 9.9~83.2 × 2.9~4.5μm; conidia obclavate-cylindrical, pale olivaceous, 2~9-septate, 29.4~88.7 × 2.9~4.5μm. The collection from China (conidiophores 6.5~86.5 × 3.9~4.8μm; conidia 30~80 × 3.7~4.3μm) is very similar to the original description.

Pseudocercospora piricola (Sawada) J. M. Yen, Bull. Trimest. Soc. Mycol. Fr. 97:154, 1981.

On *Pyrus serrulata* Rehd.: Napo (HMAS 76370).

Pseudocercospora puerariicola (W. Yamam.) Deighton, Mycol. Pap. 140:151, 1976.

On *Pueraria* sp.: Shangsi (HMAS 76371); Pingxiang (HMAS 76372).

Pseudocercospora rubicola (Thuem.) X. J. Liu & Y. L. Guo, Acta Mycol. Sinica 12:28, 1993.

On *Rubus cochinchinensis* Tratt.: Naning (HMAS 76373).

Pseudocercospora stephanicola Y. L. Guo, sp. nov. Fig.3

Maculae amphigenae, suborbiculares, 3~10 mm diam., pallide griseo-brunneae vel pallide brunneae. Caespituli amphigeni. Mycelium secundalium superficiale: hyphae pallide olivaceae, ramosae, septatae, 1.5~3μm latae. Stromata nulla vel sarva. Conidiophora singulariter ex hyphis myceli secundali oriunda vel fasciculata, pallide olivaceo-brunnea, erecta vel curvata, leviter geniculata, non ramosa, 0~3-septata, 6.5~30 (~47.5) × 3~4μm. Conidia aciculata, pallide olivacea vel olivacea, erecta vel curvata, ad apicem subobtusa vel obtusa, ad basin truncata, indistince 3~15-septata, 45~125 × 2.5~3.9μm.

Hab. in foliis vivis *Stephaniae* sp.(Menispormaceae): Shangsi, Guangxi Provincia, 29 XII 1997, leg. Y. L. Guo, no.67 (HMAS 76374, Holotypus).

Leaf spots amphigenous, subcircular, 3~10 mm diam., center pale greyish brown to pale brown, margin dark brown, with pale yellowish brown halo on the upper surface, pale brown on the lower surface. Fruiting amphigenous. Secondary mycelium external: hyphae emerging through the stomata, pale olivaceous, branched, septate, 1.5~3 μm wide. Stromata none or small, substomatal. Conidiophores borne singly as side branches on external secondary mycelial hyphae, a few emerging through stomata or in a fascicle, pale olivaceous brown, uniform in color, irregular in width, straight to curved, slightly geniculate, not branched, rounded to conic at the apex, 0~3-septate, 6.5~30 (~47.5) × 3~4 μm. Conidia acicular, pale olivaceous to olivaceous, straight to curved, apex subobtuse to obtuse, base truncate, indistinctly 3~15-septate, 45~125 × 2.5~3.9μm.

Pseudocercospora stephaniae (S. Singh) Kamal, M. K. Khan & K. K. Verma (1990) and *Cercospora stephaniae* Sawada & S. Kats. (1959) on *Stephania* spp. are different from the new species by the former having longer and wider conidiophores (70~310 × 2.5~6μm), and cylindrical to narrowly obclavate, wider conidia (25~100 × 2.5~7μm), and the latter possessing several spore scars near the tip, longer and wider conidiophores (52~400 × 4.5~6μm), and hyaline, obclavate-cylindrical, longer and wider conidia

(45~157 × 4.5~5 µm).

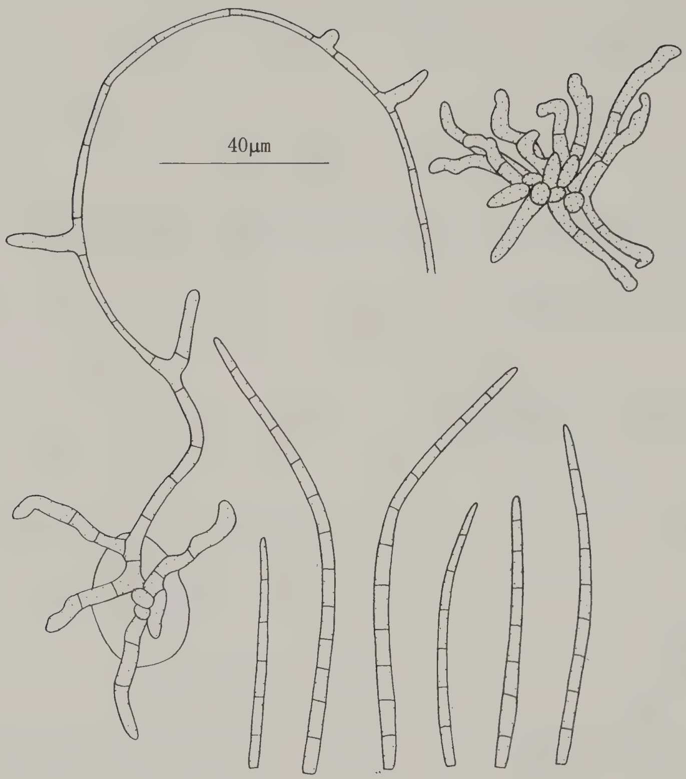

Fig.3 *Pseudocercospora stephanicola*

Pseudocercospora stizolobii (Syd. & P. Syd.) Deighton, Mycol. Pap. 140:153, 1976.
On *Stizolobium capitatum* (Sweet) Kuntze : Ningming (HMAS 59189).
On *Stizolobium deeringianum* Bort.: Nanjing (HMAS 59187).
On *Stizolobium* sp.: Ningming (HMAS 59188).

Pseudocercospora subsessilis (Syd. & P. Syd.) Deighton, Mycol. Pap. 140:154, 1976.
On *Melia azedarach* L.: Nanning (HMAS 76375), Qinzhou (HMAS 59202), Fusui(HMAS 59208).

On *Melia* sp.: Ningming (HMAS 59204), Nanning (HMAS 59205).

Pseudocercospora sugimotoana (S. Kast.) Y. L.Guo & X. J. Liu, Acta Mycol. Sinica 12:29, 1993.

On *Siegesbeckia* sp.: Nanning (HMAS 59216).

Pseudocercospora timorensis (Cooke) Deighton, Mycol. Pap. 140:154, 1976.

On *Ipomoea batatas* (L.) Lam.: Shangsi (HMAS 76376, 76377, 76378, 59229, 59230, 59231), Ningming (HMAS 59225, 59226).

On *Ipomoea* sp. : Nanning (HMAS 59232).

Pseudocercospora wellesiana (Welles) X. J. Liu & Y. L. Guo, Acta Mycol. Sinica 12:32, 1993.

On *Averrhoa* sp.: Tiandong (HMAS 59257), Nanning (HMAS 59258), Wuming (HMAS 59259).

Pseudocercosporella capsellae (Ellis & Everh.) Deighton, Mycol. Pap. 133:42, 1973.

On *Brassica pekinensis* Rupr.: Shangsi (HMAS 78379).

Pseudocercosporella ipomoeae Sawada ex Deighton, Mycol. Pap. 133:38, 1973.

On *Punica granatum* L.: Qinzhou (HMAS 59166).

Sirosporium mori (Syd. & P. Syd.) M. B. Ellis, Mycol. Pap. 87:7, 1963.

On *Morus alba* L. : Ningming (HMAS 25253).

Stenella caryotae X. J. Liu & Y. Z. Liao, Acta Microb. Sinica 20:116, 1980.

On *Caryota* sp.: Nanning (HMAS 76380).

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中国广西热带真菌区系：丝孢菌 I.

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本文报道广西热带地区的丝孢菌 52 种，其中有 3 个新种：柃木假尾孢 *Pseudocercospora euryae* Y. L. Guo 生于岗柃 *Eurya groffii* Merr.上，胡桃生假尾孢 *P. juglandicola* Y. L. Guo 生于胡桃属 *Juglans* sp. 植物上和千金藤生假尾孢 *P. stephanicola* Y. L. Guo 生于千金藤属 *Stephania* sp. 植物上; 3 个新组合：胡椒假尾孢 *Pseudocercospora artanthes* (P. Henn.) Y. L. Guo 生于荜拔 *Piper longum* L. 上，叶子花假尾孢 *P. bougainvilleae* (Rao) Y. L. Guo 生于叶子花 *Bougainvillea spectabilis* Willd.上和臭楝假尾孢 *P. didymochetonis* (Wakef.) Y. L. Guo 生于灰毛浆果楝 *Cipadessa cinerascens* (Pell.) Hand.-Mazz.上和 2 个中国新记录种：野桐菌绒孢 *Mycovellosiella malloti* Kharwar, P. N. Singh & R. K. Chaudhary 生于野桐属 *Mallotus* sp. 植物上及尖子木假尾孢 *Pseudocercospora oxysporae* (Kar & Mandal) Deighton 生于尖子木 *Oxyspora paniculata* DC.上。文中为新种提供了拉丁文简介、描述和图。研究的标本保存在中国科学院微生物研究所菌物标本馆(HMAS)。

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FUNGAL FLORA OF TROPICAL GUANGXI, CHINA: MACROFUNGI*

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ABSTRACTS: In the paper, 72 species of macrofungi are reported from tropical Guangxi, China, which belong to 41 genera, 18 families, and 7 orders. *Marasmius rotula* (Scop. : Fr.) Fr. and *Galerina vittaeformis* (Fr.) Singer are new records to China, and which are described briefly. Among them, 15 species are new records for Guangxi, 32 species edible, 28 species medicinal, 15 species poisonous, and 20 species mycorrhizal. Materials studied are deposited in the Mycological Herbarium of the Institute of Microbiology, Academia Sinica (HMAS).

KEY WORDS: Macrofungi; Tropical fungi; Auriculariales; Tremellales; Agaricales; Russulales; Boletales; Lycoperdales; Phallales

The region south of the Tropic of Cancer, Guiping, Pingguo, Debao and Napo etc., are tropical areas of Guangxi. In the tropical areas there are 25 natural preserves, among which 2 are state natural preserves, 3 provincial and 20 county natural preserves. The tropical forests of Guangxi mainly consist of water resource forest and evergreen forest in the Shiwandashan mountains, monsoon rain forest in Longgang, sharpleaf mangrove forest in Shankou natural preserve, etc. The rich water resources provide essential conditions for reproduction and growth of fungi. Studying fungi of the tropical areas of China is important. The authors in Dec. 1997 to Jan. 1998 collected macrofungi in Mt. Damingshan, Mt. Shiwandashan and some natural preserves of Napo, Pingxiang, Nanning, etc. 147 macrofungal specimens were collected and identified. During a preliminary study of our collections and some of materials on deposit in HMAS, a few interesting tropical fungi and their distributions are discussed here briefly. These macrofungi belong to 7 orders (Auriculariales, Tremellales, Agaricales, Russulales, Boletales, Lycoperdales, Phallales) in tropical Guangxi and are considered the dominant species of tropical areas, such as *Phallus rubicundus* (Bosc.) Fr. and *Dictyophora indusiata* (Vent. : Pers.) Fisch., which are distributed all over the tropics of America, Africa and Asia (Zang, 1986), and found in Longjin and Binyang of Guangxi too. Some of the species of genus *Oudemansiella* that occurr in the tropics, *Oudemansiella mucida* (Schrad.: Fr.) Hohn. and *Oudemansiella radicata* (Relh.: Fr.) Singer, were also discovered in Mt. Damingshan and Binyang of Guangxi. 6 species of the genus *Amanita*, 8 species of *Tremella,* and

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Lentinus edodes (Berk.) Singer are truly tropical species fungi (Mao, 1998). Some species are economically important. 32 species are found to be edible, 28 species medicinal, 15 species poisonous, and 20 species mycorrhizal. Famous edible Chinese fungi, for example, *Lentinus edodes*, *Tremella fuciformis* Berk. and *Dictyophora indusiata*, are also found in the tropics. *Tremella fuciformis* has been recommended as a famous and precious medicinal fungus being able to strengthen semen, enrich kidneys, lubricate lungs, promote the secretion of saliva, nourish the stomach, stop coughing, lubricate the intestines, harmonize with blood, stimulate the heart and nourish the brain. *Lentinus edodes* may prevent rickets especially in infants, brought about by disorder of phosphorus and calcium metabolism due to Vitamin D deficiency. *Dictyophora indusiata* tends to cure dysentery (Ying, 1987). *Amanita phalloides* (Fr.) Link and *A. melleiceps* Hongo in the tropical area of Guangxi are deadly poisonous. Mycorrhizal fungi play an important role in the forestry of tropical of Guangxi.

I. Auriculariales:

1. Auricularia auricula (L.) Underw., Mem. Torr. Bot. Club 12:15. 1902.

Habitat: On rotten wood in broadleaf forest.

Specimens examined: Damingshan Guangxi, WEN Hua-an 3027, 3029, 19 Dec. 1997. HMAS 63508(s), 75813(s); Napo Guangxi, WEN Hua-an 3131, 10 Jan. 1998. HMAS 63502(s).

Economic value: Edible and medicinal. Sporophores enrich energy and blood, nourishe lungs, stop hemorrhage and intigorate blood circulation. They have the effect of embellishment and invigoration of bowel movements, and are also used in the treatment of piles.

2. Auricularia delicata (Fr.) Henn., Engl. Bot. Jahrb. 17:492. 1893.

Habitat: On dead wood.

Specimens examined: Longjin Guangxi, LIANG Zi-chao 766, 2 Sep. 1958. HMAS 26879(s).

Economic value: Edible and medicinal. It enriches blood and builds up one's vital energy, lubricates lungs and stops hemorrhage.

3. Auricularia fuscosuccinea (Mont.) Farl., Bibl. Ind. 1:307. 1905.

Habitat: On rotten wood of broadleaf trees.

Specimens examined: Damingshan Guangxi, PENG Ying-bin 1949, 29 Aug. 1977. HMAS 48179(s).

Economic value: Edible.

4. Auricularia mesenterica (Dicks.) Pers., Myc. Eur. 1:97. 1822.

Habitat: On dead wood of trees.

Specimens examined: Longjin Guangxi, JIANG Guang-zheng 563, 11 Nov. 1958. HMAS 26512(s).

Economic value: Edible and medicinal. Extract of sporophore contains polysaccharides. Its inhibition rate against the growth of sarcoma 180 in white mice may reach up to 42.5~60%, and Ehrlich carcinoma is 60%.

5. Auricularia polytricha (Mont.) Sacc., Atti R. Instit. Veneto Vi 3:722. 1885.

Habitat: On rotten wood of trees.

Specimens examined: Shangsi Guangxi, WEN Hua-an 3080, 3099, 29, 31 Dec. 1997.

HMAS 75832(s), 75827(s); Nanning Guangxi, WEN Hua-an 3070, 25 Dec. 1997. HMAS 75830(s); Napo Guangxi, WEN Hua-an & Sun Shu-xiao 3139, 11 Jan. 1998. HMAS 75842(s).

Economic value: Edible and medicinal. It cures rheumatic pains in lumbar region and legs, weakness after childbirth, cramps, pains caused by external injuries, blockage of blood vessels, numbness, excessive leucorrhoea, hemafecia, bleeding of piles, and bleeding of uterus.

6. Auricularia rugosissima (Lév.) Bres., Hedwigia 53:78. 1912.

Habitat: On stumps and logs of broadleaf trees.

Specimens examined: Longjin Guangxi, LIANG Zi-chao 234, 4 Nov. 1958. HMAS 26919(s).

Economic value: Edible.

II. Tremellales:

7. Ductifera sucina (A. Moller) Wells, Mycologia 50:413. 1958.

Habitat: On rotten branch in broadleaf forest.

Specimens examined: Damingshan Guangxi, PENG Yin-bin 1853, 6 Aug. 1977. HMAS 48186(s).

8. Exidiopsis fuliginea Rick, Broteria Ser. Bot. 5:8. 1906.

Habitat: On rotten wood in broadleaf forest.

Specimens examined: Damoingshan Guangxi, PENG Yin-bin 1795, 3 Aug. 1977. HMAS 48189(s).

9. Heterochaete sinensis Teng, Sinensia 7:530. 1936.

Habitat: On dead twigs.

Specimens examined: Longjin Guangxi, JIANG Guang-zheng 544, 10 Sep. 1958. HMAS 28772(s).

10. Tremella australiensis Lloyd, Myc. Writ. IV. Letter 45, p7. 1913.

Habitat: On prostrate trunk in broadleaf forest.

Specimens examined: Damingshan Guangxi, PENG Yin-bin 1839, 4 Aug. 1977. HMAS 49704(s).

11. Tremella brasiliensis (A. Moller) Lloyd, Myc. Writ. 7: 1152. 1924.

Habitat: On rotten wood in broadleaf forest.

Specimens examined: Damingshan Guangxi, PENG Yin-bin 918, 24 May 1974.HMAS 49706(s); PENG Yin-bin 1855, 6 Aug. 1977. HMAS 49712(s).

12. Tremella carneoalba Coker, Jour. Elisha Mitchell Soc. 35: 146. 1920.

Habitat: On rotten stump in broadleaf forest.

Specimens examined: Damingshan Guangxi, PENG Yin-bin 1939, 28 Aug.1977. HMAS 49720(s).

13. Tremella coalescens L.S. Olive, Mycologia 43:678. 1951.

Habitat: On rotten branch of broadleaf tree.

Specimens examined: Damingshan Guangxi, PENG Yin-bin 1837, 4 Aug. 1977. HMAS 49719(s).

14. Tremella fibulifera A. Moller, Protobas. p. 119. 1895.

Habitat: On dead wood.

Specimens examined: Shangsi Guangxi, LIANG Zi-chao 1372, 9 Nov. 1958. HMAS

27611(s).

15. Tremella frondosa Fr., Syst. Myc. 2:212. 1822.

Habitat: On dead wood.

Specimens examined: Shangsi Guangxi, LIANG Zi-chao 1372, 9 Nov. 1958. HMAS 27611(s).

16. Tremella fuciformis Berk., Jour. Bot. 8:277. 1856.

Habitat: On prostrate trunk in broadleaf forest.

Specimens examined: Longjin Guangxi, LIANG Zi-chao 228, 4 Sep. 1958. HMAS 27614(s); Damingshan Guangxi, PENG Yin-bin 1868, 7 Aug. 1977. HMAS 49735(s).

Economic value: Edible and medicinal. It has been recommended as a famous and precious medicinal fungus. It is anti-pyretic, able to lubricate the intestines, strengthen the vital energy, harmonize with blood, stimulate the heart and nourish the brain.

17. Tremella wrightii Berk. & Curt., Linn. Soc. Jour. Bot. 10:341. 1868.

Habitat: On rotten wood in broadleaf trees.

Specimens examined: Nonggang Guangxi, PENG Yin-bin 2664, 7 Jul. 1980. HMAS 49765(s).

III. Agaricales:

18. Agaricus micromegethus Peck, Bull. N.Y. State Mus. 94:36. 1905.

Habitat: On grassy ground in the open.

Specimens examined: Binyang Guangxi, ZONG Yu-chen 42, 6 May 1970. HMAS 36257(s).

Economic value: Edible.

19. Agaricus silvaticus Schaeff.

Habitat: On ground in mixed woods.

Secimens examined: Shangsi Guangxi, WEN Hua-an & SUN Shu-xiao 3092, 10 Jan. 1998. HMAS 63503(s).

Economic value: Edible.

20. Agrocybe erebia (Fr.) Kühner, Agaricales 1:60. 1948.

Habitat: On ground in woods.

Specimens examined: Shangsi Guangxi, WEN Hua-an & SUN Shu-xiao 3088, 30 Dec. 1997. HMAS 75206(s).

Economic value: Edible.

21. Amanita melleiceps Hongo, Jour. Jap. Bot. 41:165. 1966.

Habitat: On ground in coniferous and broadleaf trees.

Specimens examined: Binyang Guangxi, ZONG Yu-chen et al. 22, 24 Jun. 1970. HMAS 35770(s).

Economic value: Deadly poisonous. Forms mycorrhizae with *Quercus* spp. and *Pinus* spp.

22. Amanita phalloides (Fr.) Link, in Wildenow, Grundr. Krauterk. 4:272.1833.

Habitat: On ground in woods.

Specimens examined: Binyang Guangxi, ZONG Yu-chen et al. 40, 4 May 1970. HMAS 35796(s).

Economic value: Deadly poisonous. Extract of sporophore inhibits the transplantation of Yoshida sarcoma in white rats and is believed to possess immune activity, containing amatoxins and phallotoxins, and can be used as a pesticide for killing red spiders etc. Forms mycorrhizae.

23. Amanita pantherina (DC.: Fr.) Krombh., Abbild. 4:Pl. 29. 1836.

Habitat: On ground in woods.

Specimens examined: Binyang Guangxi, ZONG Yu-chen et al. 39, 44, 4 May 1970. HMAS 35799(s), 35542(m).

Economic value: Poisonous. Forms mycorrhizae.

24. Amanita spissa (Fr.) Quél., Champ. Jura Vosg. 1:69. 1872.

Habitat: On ground in coniferous and broadleaf forest.

Specimens examined: Binyang Guangxi, ZONG Yu-chen 45, 10 May 1969. HMAS 37489(m).

Economic value: Poisonous. Forms mycorrhizae.

25. Amanita spissacea Imai, Bot. Mag. Tokyo, 47:427. 1933.

Habitat: On ground in coniferous and broadleaf forest.

Specimens examined: Binyang Guangxi, MAO Xiao-lan 47, 11 May 1970. HMAS 35545(m).

Economic value: Poisonous. Forms mycorrhizae.

26. Amanita strobiliformis (Paulet ex Vittad.) Bertillon, Dict. Encycl. Sci. medic. I. 3:499. 1866.

Habitat: On ground in broadleaf forest.

Specimens examined: Binyang Guangxi, ZONG Yu-chen 34, 29 Jun. 1970. HMAS 35531.

Economic value: Poisonous. Forms mycorrhizae.

27. Amanita vaginata (Bull.: Fr.) Vittad., Tent. Myc. Amanitarum Illustr: 30. 1826.

Habitat: On ground in coniferous and broadleaf forest.

Specimens examined: Binyang Guangxi, ZONG Yu-chen 21, 25 Jun. 1970. HMAS 35544(m).

Economic value: Edible. Forms mycorrhizae.

28. Armillaria mellea (Vahl) Quél., Champ. Jura Vosg. 1:75. 1872.

Habitat: On base of trunk of living trees, both coniferous and broadleaf trees, causing root-rot and luminescence of decayed wood.

Specimens examined: Nanning Guangxi, WEI Bing-gang 429, 11 Oct. 1981. HMAS 41215(s).

Economic value: Edible and medicinal. Sporophore contains D-threitol, and Vitamin A. It cures pains in legs and lumbago, rickets, and epilepsy. Taken regularly, it may prevent ophthalmocopia, night blindness, dermal dryness, and increase resistance to certain infections in respiratory and alimentary tracts.

29. Bolbitius vitellinus (Pers.) Fr., Epicr. 254. 1838.

Habitat: On manured ground in woods.

Specimens examined: Napo Guangxi, WEN Huan-an 3140, 11 Jan. 1998. HMAS 75819(s).

Economic value: Poisonous.

30. Coprinus insignis Peck, N.Y. State Mus. Rep. 26:60. 1874.

Habitat: On rotten wood in broadleaf forest.

Specimens examined: Shansi Guangxi, WEN Hua-an 3081, 29 Dec. 1997. HMAS 75815(s).

Economic value: Medicinal. The inhibition rate against both sarcoma 180 in white mice and Ehrlich carcinoma is 70%.

31. Cortinarius decipiens (Pers.) Fr., Epicr. 312. 1838.

Habitat: On ground in woods.

Specimens examined: Shangsi Guangxi, WEN Hua-an & SUN Shu-xiao 3108, 30 Dec. 1997. HMAS 75208(s).

Economic value: Forms mycorrhizae.

32. Crepidotus mollis (Schaeff.: Fr.) Gray, Nat. Arr. Brit. Pl. 1:616. 1821.

Habitat: On dead wood.

Specimens examined: Damingshan Guangxi, WEN Huan-an 3018, 19 Dec. 1997. HMAS 75823(s).

Economic value: Edible.

33. Entoloma prunuloides (Fr.) Quél., Champ. Jura Vosg. 1:117. 1872.

Habitat: On ground in woods.

Specimens examined: Binyang Guangxi, ZONG Yu-chen et al. 19, 23 Apr. 1970. HMAS 37335(s).

34. Galerina vittaeformis (Fr.) Singer, Trudy Bot. Inst. Akad. Nauk SSSR. 6:472. 1950.

Pileus 0.7~1.7cm broad , convex to campanulate, surface glabrous, ochraceous brown to ochre radially striate; gill adnate, distant, pale ochraceous; stipe 2.5~5cm long, 1.0 cm thick, hollow, ochraceous brownish; spores ovoid to ellipsoid, 7.2~9.0x5.4um, verruculose, with a smooth suprahilar plage; pleurocystidia hyaline, ventricose below, tapering above, 47~61.2x7.2~9.0um.

Habitat: On ground in broadleaf forest.

Specimens examined: Damingshan Guangxi, WEN Hua-an & SUN Shu-xiao 3060, 20 Dec. 1997. HMAS 75235(s).

35. Gymnopilus sapineus (Fr.) Maire, Treb. Mus. Cienc. Nat. Barc. 15(2):96.1933.

Habitat: On dead wood in broadleaf forest.

Specimens examined: Napo Guangxi, WEN Hua-an 3123, 10 Jan. 1998. HMAS 63504(s).

36. Hygrocybe aurantia Murrill, Mycologia, 3: 195. 1911.

Habitat: On ground in woods and grassy places.

Specimens examined: Napo Guangxi, WEN Hua-an & SUN Shu-xiao 3143, 12 Jan. 1998. HMAS 75236(s).

37. Laccaria amethystea (Bull.) Murrill, N. Am. Fl. 10:1. 1914.

Habitat: On ground in broadleaf forest.

Specimens examined: Napo Guangxi, WEN Hua-an & SUN Shu-xiao 3128, 10 Jan. 1998. HMAS

Economic value: Edible and medicinal. Forms mycorrhizae.

38. Laccaria laccata (Scop.:Fr.) Berk. et Br., Ann. Mag. Nat. Hist. 12:371. 1883.

Habitat: On ground in broadleaf forest.

Specimens examined: Damingshan Guangxi, WEN Huan-an 3001, 18 Dec. 1997.

HMAS 75825(s).

Economic value: Edible and medicinal. Forms mycorrhizae.

39. Lentinus edodes (Berk.) Singer, Lilloa 22:279. 1949.

Habitat: On prostrate trunks of broadleaf forest.

Specimens examined: Shangsi Guangxi, WEN Hua-an & SUN Shu-xiao 3075, 27 Dec. 1997. HMAS 75812(s); Napo Guangxi, WEN Hua-an & SUN Shu-xiao 3136, 11 Jan. 1998. HMAS 75814(s); Damingshan Guangxi, WEN Hua-an 3011, 19 Dec. 1997. HMAS 63507(s).

Economic value: Edible and medicinal. Taken regularly it may prevent rickets especially in infants, brought about by disorder of phosphorus and calcium metabolism due to Vitamin D deficiency.

40. Lepiota prominens (Fr.) Sacc., Syll. Fung. 5:30. 1887.

Habitat: On ground in pastures.

Specimens examined: Binyang Guangxi, XU Lian-wang 36, 1 May 1970. HMAS 37327(s).

Economic value: Edible.

41. Marasmiellus picipes (Murr.) Singer, Nov. Hedw. 44:199. 1973.

Habitat: On fallen leaves in broadleaf forest.

Specimens examined: Damingshan Guangxi, WEN Hua-an & SUN Shu-xiao 3039, 19 Dec. 1997. HMAS 75209(s).

42. Marasmius haematocephalus (Mont.) Fr., Epicr. 382. 1838.

Habitat: On fallen leaves in woods.

Specimens examined: Damingshan Guangxi, WEN Hua-an & SUN Shu-xiao 3023, 19 Dec. 1997. HMAS 75207(s).

43. Marasmius rotula (Scop.: Fr.) Fr., Epicr. Myc. 385. 1838.

Pileus membranous, 2~5mm broad, convex, depressed, whitish to light pinkish-whitish, slightly dark at center, glabrous, margin sulcate-striates; flesh thin, white; gill free, whitish-pallid, distant, light blackish when dry; stipe 2~5cm long, 0.1cm thick, glabrous, horny, hollow, slightly blackish-brown below, light apex; spores elongate, 7.2~9.0x3.6um, hyaline; cystidia fusoid-ventricose, 27~32.4x5.4um.

Habitat: On rotten leaves in broadleaf forest.

Specimens examined: Damingshan Guangxi, WEN Hua-an 3013, 19 Dec. 1997. HMAS 63506(s).

44. Oudemansiella mucida (Schrad.: Fr.) Hohn., K. Akad. Wiss. Wien Math. Nat. Kl. Sitz. 119:885. 1910.

Habitat: On rotten wood in broadleaf forest.

Specimens examined: Damingshan Guangxi, WEN Hua-an 3044,3144, 20, Dec. 1997. HMAS 73511(m),75212(s).

Economic value: Edible and medicinal. It may produce mucidin, which has antifungal effects.

45. Oudemansiella radicata (Relh.: Fr.) Singer, Ann. Myc. Berl. 34:333. 1936.

Habitat: On ground in woods.

Specimens examined: Binyang Guangxi, MAO Xiao-lan 16, 23 Apr. 1970. HMAS 37310(s).

Economic value: Edible and medicinal. It acts against spontoneous hypertension in white rats, and intro-abdominal injection shows a strong effect on lowering blood pressure.

46. Naematoloma fasciculare (Huds.) P. Karst, Bidr. Finl. Nat. Folk 32:496. 1879.

Habitat: On dead wood in mixed forest.

Specimens examined: Nanning Guangxi, WEN Hua-an & SUN Shu-xiao 3109, 4 Jan. 1998. HMAS 75843(s).

Economic value: Poisonous and medicinal.

47. Panaeolus solidipes Peck, N. Y. State Mus. Rep. 23: 101. Pl. 4.f.1-5. 1872.

Habitat: On dung in broadleaf woods.

Specimens examined: Nanning Guangxi, WEN Hua-an 3068, 24 Dec. 1997. HMAS 75836(s); Napo Guangxi, WEN Hua-an & SUN Shu-xiao 3124, 10 Jan. 1998. HMAS 72999(s);Shangsi Guangxi, WEN Hua-an & SUN Shu-xiao 3083, 29 Dec. 1997. HMAS 72941(s).

48. Pholiota alnicola (Fr.) Singer, Lilloa 22: 516. 1951.

Habitat: On decayed wood.

Specimens examined: Shangsi Guangxi, WEN Hua-an 3102, 2 Jan. 1998. HMAS 75841(s); Damingshan Guangxi, WEN Hua-an 3053, 20 Dec. 1997. HMAS 72942(s).

49. Pholiota junonia (Fr.) P. Karst., Bidr. Finl. Nat. Folk 32:301. 1879.

Habitat: On prostrate rotten wood.

Specimens examined: Nanning Guangxi, WEI Bing-gang 310, 14 Oct. 1981. HMAS 42360(m).

Economic value: Poisonous.

50. Pleurotus ostreatus (Jacq.: Fr.) Quél., Champ. Jura. Vosg. 1:112. 1872.

Habitat: On rotten wood of broadleaf forest.

Specimens examined: Nanning Guangxi, WEN Hua-an & SUN Shu-xiao 3067, 24 Dec.1997. HMAS 75821(s); Napo Guangxi, WEN Hua-an & SUN Shu-xiao 3137, 1 Jan. 1998. HNAS 75839(s).

Economic value: Edible and medicinal. Sporophore made into 'Tendo-easing powder', cures lumbago and painful legs, numbed limbs, and discomfort in tendons and blood vessels.

51. Psathyrella gracilis (Fr.) Quél., Champ. Jura Vosg. 152. 1872.

Habitat: On ground in woods.

Specimens examined: Nanning Guangxi, WEN Hua-an & SUN Shu-xiao 3147, 25 Dec. 1997. HMAS 72832(s).

52. Psilocybe fasciata Hongo, Jour. Jap. Bot. 32:144, f. d-f. 1957.

Habitat: On ground in woods.

Specimens examined: Shangsi Guangxi, WEN Hua-an & SUN Shu-xiao 3093, 1 Jan. 1998. HMAS 75824(s).

Economic value: Poisonous.

53. Schizophyllum commune Fr., Obs. Myc. 1:103. 1815.

Habitat: On dead wood of trees.

Specimens examined: Nanning Guangxi, WEN Hua-an & SUN Shu-xiao 3072, HMAS 73514(m); Pingxiang Guangxi, WEN Hua-an & SUN Shu-xiao 3146, 6 Jan.

1998. HMAS 73513(m); Napo Guangxi, WEN Hua-an & SUN Shu-xiao 3145(s), 10 Jan. 1998. HMAS 73512(m).

Economic value: Edible and medicinal.

54. Tricholoma flavovirens (Fr.) S. Lundell, in Singer Agaricales, 218. 1949.

Habitat: On ground in woods.

Specimens examined: Binyang Guangxi, ZONG Yu-chen et al. 17, 23 Apr. 1970. HMAS 36044(s).

Economic value: Edible . Forms mycorrhizae.

IV. Russulales:

55. Lactarius blennius Fr., Epicr. 337. 1876.

Habitat: On ground in woods.

Specimens examined: Longjin Guangxi, LIU Heng-ying 370, 9 Sep. 1958. HMAS 26366(m).

Economic value: Edible. Forms mycorrhizae.

56. Russula foetens (Pers.) Fr., Epicr. 359. 1838.

Habitat: On ground in broadleaf and coniferous woods.

Specimens examined: Binyang Guangxi, ZONG Yu-chen 28, 27 Apr. 1970. HMAS 35530.

Economic value: Poisonous and medicinal. When made into 'Tendo-easing pills', they tend to cure lumbago and painful legs, numbed limbs, discomfort in tendons and bones. Forms mycorrhizae.

57. Russula fragilis (Pers.) Fr., Epicr. 359. 1838.

Habitat: On ground in woods.

Specimens examined: Binyang Guangxi, ZONG Yu-chen 30, 27 Apr. 1970. HMAS 36935(s).

Economic value: Poisonous. Forms mycorrhizae.

58. Russula olivacea (Schaeff.) Fr., Epicr. 356. 1838.

Habitat: On ground in woods.

Specimens examined: Nanning Guangxi, LI Hai-ying , 15 May 1988. HMAS 54040(m).

Economic value: Edible. Forms mycorrhizae.

59. Russula virescens (Schaeff.) Fr., Epicr. 355. 1838.

Habitat: On ground in woods.

Specimens examined: Binyang Guangxi, XU Lian-wang 43, 6 May 1970. HMAS 32926(s).

Economic value: Edible and medicinal. Forms mycorrhizae.

V. Boletales:

60. Gomphidius roseus (Fr.) Gillet, Champ. Fr. 623. 1874.

Habitat: On dead wood in coniferous and broadleaf forest.

Specimens examined: Nanning Guangxi, WEN Hua-an 3111, 4 Jan. 1998. HMAS 63509(s); Pingxiang Guangxi, WEN Hua-an 3144, 6 Jan. 1998. HMAS 75835(s).

Economic value: Edible. Forms mycorrhizae.

61. Gomphidius viscidus (L.) Fr., Epicr. 319. 1838.

Habitat: On ground under pines.

Specimens examined: Shangsi Guangxi, WEN Hua-an & Sun Shu-xiao 3073, 3077, 27, 28 Dec. 1997. HMAS 75826(s), 75210(s), 3096, 1 Jan. 1998. HMAS 75211(s).

Economic value: Edible and medicinal. It cures neurodermatitis. Forming mycorrhizae.

62. Pulveroboletus ravenelii (Berk. & M.A. Curtis) Murrill, Mycologia 1:9. 1909.

Habitat: On ground in wood.

Specimens examined: Binyang Guangxi, ZONG Yu-chen 46, 11 May 1970. HMAS 35927(s).

Economic value: Poisonous and medicinal. When made into 'tendo-easing pills', they tend to cure lumbago and painful legs, numbed limbs. Forms mycorrhizae.

63. Paxillus atrotomentosus (Batsch) Fr., Epicr. 317. 1838.

Habitat: On stumps of conifers and ground at base of coniferous trees.

Specimens examined: Nanning Guangxi, WEI Bin-gang 270, 27 Sep. 1981. HMAS 42359(m).

Economic value: Poisonous and medicinal. Sporophore tends to stop bleeding, relieve swelling, internal heat, and fever.

64. Paxillus corrugatus G.F. Atk., Mushrooms 170. 1900.

Habitat: On log of conifers.

Specimens examined: Shangsi Guangxi, LIANG Zi-chao 1727, 16 Nov. 1958. HMAS 27847(s).

Economic value: Poisonous.

65. Paxillus panuoides Fr., Epicr. 318. 1838.

Habitat: On wood of *Pinus* spp. Specimens examined: Longjin Guangxi, JIANG Guang-zheng 596, 15 Sep. 1958. HMAS 27291(s).

Economic value: Causing decay.

66. Suillus bovinus (L.: Fr.) Kuntze, Rev. Gen. Plant. 3(2): 535. 1898.

Habitat: On ground in coniferous forest.

Specimens examined: Shiwandashan Guangxi, WEN Hua-an & SUN Shu-xiao 3076, 28 Dec. 1997. HMAS 76656(m); Nanning Guangxi, WEN Hua-an & SUN Shu-xiao 3112, 4 Jan. 1998. HMAS 76461(m); Pingxiang Guangxi, WEN Hua-an & SUN Shu-xiao 3113, 6 Jan. 1998. HMAS 76466(m).

Economic value: Edible and medicinal. Forms mycorrhizae.

67. Suillus granulatus (L.) Kuntze, Rev. Gen. Plant. 3(2): 535. 1898.

Habitat: On ground in wood.

Specimens examined: Binyang Guangxi, ZONG Yu-chen 5, 20 Apr. 1970. HMAS 36948(s).

Economic value: Edible and medicinal. It is used for treating Kaschin-Beck disease. Forms mycorrhizae.

VI. Lycoperdales:

68. Calvatia lilacina (Mont. & Berk.) Lloyd, Myc. Writ. 1: Austr. 35, pl. 35, f. 1, 1905.

Habitat: On ground in open grassy places.

Specimens examined: Longjin Guangxi, JIANG Guang-zheng 27, 31 Aug. 1958. HMAS 25822.

Economic value: Edible when young and medicinal when mature.

69. Lycoperdon pusillum Batsch, Elench. Fung., Cont. II. 124, pl. 41.f.228, 1789.

Habitat: On ground.

Specimens examined: Longjin Guangxi, LIANG Zi-chao 246, 4 Sep. 1958. HMAS 28244(s); JIANG Guang-cheng 828, 23 Sep. 1958. HMAS 28246(s).

Economic value: Medicinal.

70. Lycoperdon pyriforme Schaeff., Icon. Fung. Bav. 4:128. 1774.

Habitat: On rotten wood and base of trunk.

Specimens examined: Damingshan Guangxi, WEN Hua-an 3024, 18 Dec. 1997. HMAS 73466(m).

Economic value: Edible before maturity and medicinal. Reports show that it possesses anticarcinogenic effects.

VII. Phallales:

71. Dictyophora indusiata (Vent. : Pers.) Fisch., Ann. Myc. 25:472. 1927.

Habitat: On ground.

Specimens examined: Longjin Guangxi, JIANG Guang-zheng 595, 15 Sep. 1958. HMAS 26542(s).

Economic value: Edible and medicinal. It tends to cure dysentery.

72. Phallus rubicundus (Bosc) Fr., Syst. Myc. 2:284. 1823.

Habitat: On ground.

Specimens examined: Binyang Guangxi, ZONG Yu-chen 1, 20 Apr. 1970. HMAS 36266(s).

Economic value: Medicinal. It tends to cure 'sores and subcutaneous ulcers, scabies, carbuncle and fistula'. Remove gleba of the sporophore, 'dry it under the sun and grind into powder, mix with oil for application' or apply the powder on wounds.

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MYCOTAXON

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FUNGAL FLORA OF TROPICAL GUANGXI, CHINA: APHYLLOPHORALES S. L.

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摘要　本文的非褶菌和韧革菌标本是黄逢源、梁子超、刘恒英、赵继鼎、徐连旺等前辈和作者自1953年到1997年从广西南宁、上思、宁明、龙舟、邕宁、凭祥、那坡等地采集的。共4科（Ganodermataceae, Polyporaceae, Hymenochaetaceae, Stereaceae），41属，77种，其中有21种在当地是首次发现①(Tai 1979, Teng 1996, Zhao et al. 1998)，16种可作药用②(Ying et al. 1987, Zhao 1989)。以上所有研究标本均保存在中国科学院微生物研究所真菌地衣标本馆（HMAS）

Specimens of the Aphyllophorales and Stereales to which were collected in tropical Guangxi from 1953 to 1997 have been studied. Seventy-seven species of 41 genera belonging to 4 families (Ganodermataceae, Hymenochaetaceae, Polyporaceae and Stereaceae) were identified. Among them twenty-one species are found for the first time from Guangxi① (Tai 1979, Teng 1996, Zhao et al.1998) and 16 species can be used as Chinese medicinal herbs② (Ying et al. 1987, Zhao 1989). All specimens examined are deposited in HMAS.

1. ①②*Amauroderma rude* (Berk.) G. Cunn., Proc. Linn. Soc. N. S. W. 75: 239, 1950.
   Specimens examined: Nanning Guangxi: X. Q. Zhang HMAS 73041.
2. *Antrodia serialis* (Fr.) Donk, Persoonia 4: 340, 1966.
   Specimens examined: Shangsi Guangxi: Z. C. Liang HMAS 32013.
3. *Auriscalpium vulgare* Gray, Nat. Arr. Brit. Pl. 1: 650, 1821.
   Specimens examined: Ningming Guangxi: Z. C. Liang HMAS 26516.
4. ①*Bjerkandera adusta* (Willd.: Fr.) P. Karst., Medd. Soc. Faun. Fl. Fenn. 5: 38, 1879.
   Specimens examined: Wuming Guangxi: X. Q. Zhang HMAS 72765.
5. ①②*Bjerkandera fumosa* (Pers.: Fr.) P. Karst., Medd. Soc. Faun. Fl. Fenn. 5: 38,

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1879.
Specimens examined: Wuming Guangxi: X. Q. Zhang HMAS 72792; Shangsi Guangxi: X. Q. Zhang HMAS 72779, 72794, 72781, 72766; Napo Guangxi: X. Q. Zhang HMAS 72778.

6. *Cerrena meyenii* (Klotzsch) L. Hansen, Nat. Hist. Rennell Isl. 3: 129, 1960.
Specimens examined: Longzhou Guangxi: B. G. Wei HMAS 39631, 39683.

7. *Cladoderris infundibuliformis* (Klotzsch) Fr., Fungi Natal. 21, 1848.
Specimens examined: Shangsi Guangxi: Z. C. Liang HMAS 26084.

8. *Coriolopsis telfarii* (Klotzsch) Ryvarden, Norw. J. Bot. 19: 230, 1972.
Specimens examined: Shangsi Guangxi: Z. C. Liang HMAS 26713.

9. *Cyclomyces tabacinus* (Mont.) Pat., Essai Tax. P. 98, 1900.
Specimens examined: Napo Guangxi: X. Q. Zhang 2524; Shangsi Guangxi: F.Y.Huang HMAS 27463.

10. *Daedalea sulcata* (Berk.) Ryvarden, Norw. J. Bot. 24, p. 215, 1977.
Specimens examined: Shangsi Guangxi: Z. C. Liang HMAS 26182.

11. ②*Daedaleopsis tricolor* (Bull.: Fr.) Bondartsev & Singer, Ann. Mycol. 39: 64, 1941.
Specimens examined: Shangsi Guangxi: F. Y. Huang HMAS 26588, Z. C. Liang HMAS 25937, X. Q. Zhang HMAS 74994.

12. ②*Earliella scabrosa* (Pers.) Gilb. & Ryvarden, Mycotaxon 22: 364, 1985.
Specimens examined: Shangsi Guangxi: Z. C. Liang HMAS 25214.

13. ①*Flabellophora licmophora* (Massee) Corner, Ad Polyporaceas IV, p. 32, Fig. 3, 1987.
Specimens examined: Shangsi Guangxi: X. Q. Zhang HMAS 72761, 72769; Napo Guangxi: X. Q. Zhang HMAS 72764.

14. *Fomitopsis carnea* (Blume & Nees) Imazeki, Bull. Tokyo Sci. Mus. 6: 92, 1943.
Specimens examined: Ningming Guangxi: Z. C. Liang HMAS 25846.

15. *Fomitopsis feei* (Fr.) Kreisel, Univ. Habana Ser. 4, Cienc. Biol. 16: 83, 1971.
Specimens examined: Shangsi Guangxi: Z. C. Liang HMAS 25299.

16. ②*Fomitopsis pinicola* (Sw.: Fr.) P. Karst., Krit. Finl. Basidsv., p. 306, 1889.
Specimens examined: Ningming Guangxi: Z. C. Liang HMAS 25877; Shangsi Guangxi: X. Q. Zhang HMAS 75244, 76471, 72877, 76472.

17. ①②*Ganoderma applanatum* (Pers.) Pat., Bull. Soc. Mycol. Fr. 5: 67, 1889.
Specimens examined: Wuming Guangxi: X. Q. Zhang HMAS 73031.

18. *Ganoderma australe* (Fr.) Pat., Bull. Soc. Mycol. Fr. 5: 67, 1889.
Specimens examined: Wuming Guangxi: X. Q. Zhang HMAS 73476, 74914, 74913; Shangsi Guangxi: X. Q. Zhang HMAS Guangxi: X. Q. Zhang HMAS 72836, 25173; Napo Guangxi: X. Q. Zhang HMAS 73475, 73035, 73482 Ningming Guanxi: Z. C. Liang HMAS 26156, 26173; Longzhou Guangxi: B. G. Wei HMAS 39410.

19. ①*Ganoderma brownii* (Murrill) Gilb., Mycologia 53: 505, 1962.
Specimens examined: Wuming Guangxi: X. Q. Zhang HMAS 73032.

20. *Ganoderma daiqingshanense* J. D. Zhao, Acta Mycol. Sinica 8(1): 25, Fig. 1, Pl.11-1, 1989.

Specimens examined: Shangsi Guangxi: Z. C. Liang HMAS 25909.

21. *Ganoderma hainanense* J. D. Zhao, L. W. Hsu & X. Q. Zhang, Acta Microbiol. Sinica 19(3): 269, Fig. 1-3, Pl.1-3, 1979.
    Specimens examined: Lingshan 42742.
22. *Ganoderma shangsiense* J. D. Zhao, Acta Mycol. Sinica 7(1): 13, Fig. 2, Pl. 1-2, 1988.
    Specimens examined: Shangsi Guangxi: Z. C. Liang HMAS 29741.
23. ②*Gloeophyllum saepiarium* (Fr.) P. Karst., Hattsv. 2: 79, 1882.
    Specimens examined: Nanning Guangxi L. W. Hsu HMAS 16243, 16244, 16712
24. *Heterobasidion annosum* (Fr.) Bref., Unters. Gesamtg. Mykol. 8: 154, 1888.
    Specimens examined: Ningming Guangxi: Z. C. Liang HMAS 30846.
25. ②*Hexagonia apiaria* Pers.: Fr., Epicr. P. 497, 1838.
    Specimens examined: Yongning Guanxi: Z. C. Liang HMAS 26561; Nanning Guangxi: X. Q. Zhang HMAS 72739.
26. *Hexagonia subtenuis* Berk. ex Cooke, Grevillea 10: 133, 1882.
    Specimens examined: Longzhou Guangxi: B. G. Wei HMAS 51487.
27. *Hexagonia tenuis* (Hook.) Fr., Epicr. P. 498, 1838.
    Specimens examined: Nanning Guangxi: X. Q. Zhang HMAS Guangxi: X. Q. Zhang HMAS 72773, 72990; Shangsi Guangxi: X. Q. Zhang HMAS 72751, 63500, 72772, 72759, 73457, 63501; Ningming Guangxi: Z. C. Liang HMAS 25178.
28. *Hydnochaete japonica* Lloyd, Mycol. Writ. 4, Letter 61: 7, 1916.
    Specimens examined: Shangsi Guangxi: Z. C. Liang HMAS 35528, 35618.
29. *Hydnopolyporus fimbriatus* (Fr.) D. A. Reid, Persoonia 2: 151, 1962.
    Specimens examined: Longzhou Guangxi: H. Y. Liu HMAS 28843.
30. ①*Hymenochaete adusta* (Lév.) Bres., Hedwigia 51: 323, 1911.
    Specimens examined: Napo Guangxi: X. Q. Zhang HMAS 73484.
31. *Hymenochaete nigricans* (Lév.) Pat., Bull. Soc. Myc. Fr. 23: 75, 1907.
    Specimens examined: Shangsi Guangxi: F. Y. Huang HMAS 27143.
32. *Hymenochaete sallei* Berk. & M. A. Curtis, Jour. Linn. Soc. Bot. 10: 333, 1868.
    Specimens examined: Ningming Guangxi: Z. C. Liang HMAS 26188.
33. *Inonotus tabacinus* (Mont.) P. Karst., Rev. Mycol. 3: 19, 1881.
    Specimens examined: Shangsi Guangxi: F. Y. Huang HMAS 27463.
34. ①*Irpex consors* Berk., J. Linn. Soc. Bot. 16: 51, 1877.
    Specimens examined: Wuming Guangxi: X. Q. Zhang HMAS 72763, 72755; Napo Guangxi: X. Q. Zhang HMAS 72756, 63495.
35. ①②*Irpex flavus* Klotzsch, Linnaea 8: 488, 1833.
    Specimens examined: Shangsi Guangxi: X. Q. Zhang HMAS 73456.
36. ①*Irpex lacteus* (Fr.: Fr.) Fr., Elench. Fung. P. 145, 1828.
    Specimens examined: Shangsi Guangxi: X. Q. Zhang HMAS 63493.
37. *Irpex vellereus* Berk. & Broome, J. Linn. Soc. Bot. 14: 61, 1878.
    Specimens examined: Shangsi Guangxi: Z. C. Liang HMAS 29780.
38. *Lenzites acuta* Berk., Lond. J. Bot. 1: 146, 1842.
    Specimens examined: Nanning Guangxi: J. D. Zhao HMAS 16249.

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FUNGAL FLORA OF TROPICAL GUANGXI, CHINA: A PRELIMINARY CHECKLIST OF RUST FUNGI*

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ABSTRACT: Sixty-nine rust species are reported from the tropical region of Guangxi Province, China, including a new species, *Puccinia stenospora* J.Y. Zhuang & S.X. Wei, and a new record in China, *Uromyces cucullatus* Syd. & P. Syd.

This paper presents a taxonomic study of rust fungi occurring in the tropical region of Guangxi (Kwangsi) Province of China in the south to the Tropic of Cancer, adjacent to Vietnam. Sixty-nine species are reported here, including a new species and a new record in China. This is only a preliminary contribution toward the understanding of tropical rusts of China and supplement informations in Wang's INDEX UREDINEARUM SINENSIUM (1951) and Tai's SYLLOGE FUNGORUM SINICORUM (1979). Most of the specimens examined were obtained from Herbarium Mycologicum Academiae Sinicae (HMAS), and some from Arthur Herbarium of Purdue University (PUR), U.S.A. Collections made by the senior author in this region during the field work in December, 1997 and January, 1998 are included.

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Distr.: Japan, China.

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Distr.: Japan, Russian Far East, Korea, China.

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Distr.: Japan, China.

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Distr.: Southern U.S.A., Guatemala, West Indies, South America, southern China.

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Distr.: Japan, Korea, China, India.

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Distr.: North America, Central America; Japan, Russian Far East, China, India, Nepal.

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Distr.: Indonesia, Philippines, southern China, Nepal.

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Distr.: India, Burma, southern China.

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Distr.: Philippines, Japan, southern China.

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Distr.: Italy, Portugal, Algeria, Egypt, Central to South Africa, India, South

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Distr.: Philippines, Japan, southern China.

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Distr.: Japan, Korea, China.

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Distr.: Japan, China.

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Distr.: India, Thailand, southern China.

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Distr.: Philippines, Indonesia, India, southern China.

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Distr.: southern U.S.A., West Indies, South America, India, Indonesia, Papua New Guinea, Philippines, South China.

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Distr.: Senegal, Cote d'Ivoire, Philippines, southern China.

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Distr.: South America, Japan, southern China, Indonesia, Malaysia, Thailand, Philippines, Papua New Guinea.

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Distr.: Japan, China, Korea, Russian Far East, U.S.A., Mexico.

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Distr.: India, Burma, China, South Africa.

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Distr.: southern China, Japan, Philippines, Thailand.

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On *Polygonum chinense* L., Damingshan Mts., 1997 XII 18, J.Y. Zhuang 5704 (HMAS 77490), 1997 XII 20, J.Y. Zhuang 5721 (HMAS 77497); Nanning, 1997 XII 25, J.Y. Zhuang 5749 (HMAS 77491), 5756 (HMAS 77492); Shangsi, 1997 XII 28, J.Y. Zhuang 5772 (HMAS 77493); 1997 XII 29, J.Y. Zhuang 5795 (HMAS 77494), 5801 (HMAS 77495); Pingxiang, 1998 I 6, J.Y. Zhuang 5901 (HMAS 77496).

Distr.: Sri Lanka, Indonesia, Philippines, India, Nepal, Vietnam, Japan, southern China.

Puccinia coronopsora Cummins, Bull. Torrey Bot. Club 76: 36, 1949.

On *Lindera communis* Hemsl., Napo , 1998 I 11, X.Q. Zhang 5912(HMAS 77392).

Distr.: southern China.

Puccinia elytrariae Henn., Hedwigia 34: 320, 1895.

On *Rostellularia procumbens* (L.) Nees, Rongxian, 1933 VIII 12, S. Y. Cheo2507(HMAS 4523).

Distr.: Brazil, Mexico, Japan, southern China.

Puccinia erythropus Dietel, Bot. Jahrb. 37: 101, 1905.

On *Saccharum officinarum* L., Debao, 1958 XII 20, Z.C. Liang 1985(HMAS 36571), 1958 XII 21, Z.C. Liang 2005(HMAS 37580), 1958 XII 25, Z.C. Liang 2014(HMAS 42485).

Distr.: Japan, China, Russian Far East, Philippines.

Puccinia fagopyricola Jørstad, Nytt Mag. Bot. 6: 137, 1958.

On *Fagopyrum dibotrys* (D. Don) Hara, Damingshan, 1997 XII 20, J.Y. Zhuang 5720(HMAS 77502).

On *Fagopyrum esculentum* K. Monch, Jingxi, 1958 XII 19, H.Y. Liu 2427(HMAS 56265).

Distr.: India, Nepal, southern China.

Puccinia hemerocallidis Thüm., Bull. Soc. Imp. Nat. Moscou 55: 81, 1880.

On *Hemerocallis fulva* L., Ningming, 1958 X 22, Z.C. Liang 1311(HMAS 54188).

Distr.: Russian Far East, Korea, China, Japan.

Puccinia heterospora Berk. & M.A. Curtis, Journ. Linn. Soc. London, 14: 91, 1873.

On *Abutilon avicennae* Gaertn., Ningming, 1958 X 7, Z.C. Liang 851(HMAS 35149).

Distr.: southern North America, Central America, South America, Africa, Australia, Philippines, India, Nepal, southern China.

Puccinia kraussiana Cooke, Grevillea 10:126, 1882.

On *Heterosmilax japonica* Kunth var. *gaudichaudiana* (Kunth) F.T Wang & T. Tang , Shangsi, 1997 XII 29, J.Y. Zhuang 5811 (HMAS 77473).

Distr.: South Africa, Togo, Kenya, Malawi, India, Burma, Indonesia, southern China.

Puccinia kyllingiae-brevifoliae Miura ex S. Ito & Homma, Trans. Sapporo Nat. Hist. Soc. 15:128, 1938.

On *Kyllinga brevifolia* Rottb., Shangsi, 1997 XII 31, J.Y. Zhuang 5847 (HMAS 77474); Napo, 1998 I 10, J.Y. Zhuang 5906 (HMAS 77475).

Distr.: Japan, southern China, Brazil, Colombia, Martinique, Puerto Rico, Reunion.

Puccinia kuehnii E.J. Butler, Ann. Mycol. 12:82, 1914.

On *Saccharum* sp., Jingxi, 1958 XII 12, H.Y. Liu 2323(HMAS 24521).

Distr.: Indonesia, Philippines, Sri Lanka, India, Nepal, Burma, Japan, southern China, Australia, South Africa.

Puccinia lactucae-debilis Dietel, Ann. Mycol. 6: 225, 1908.

On *Lactuca* sp., Nanning, 1958 IX 19, G.Z. Jiang 7(HMAS 24524).

Distr.: Japan, China, Korea, Russian Far East.

Puccinia lactucae-repentis K. Miyabe & T. Miyake ex Syd. & P. Syd., Ann. Mycol. 11:96, 1913.

On *Lactuca* sp., Ningming, 1958 X 17, Z.C. Liang 1196(HMAS 36596).

Distr.: Japan, China, Korea, Russian Far East.

Puccinia lateritia Berk. & M.A. Curtis, Jour. Acad. Phil. 2:281, 1853.

On *Hedyotis hedyotidea* DC., Shangsi, 1997 XII 27, J.Y. Zhuang 5758 (HMAS 77448), 5762 (HMAS 77449), 5771 (HMAS 77421); 1997 XII 30, J.Y. Zhuang 5831 (HMAS 77418); Pingxiang, 1998 I 6, J.Y. Zhuang 5895 (HMAS 77450).

Distr.: southern U.S.A., Mexico, Honduras, Porto Rico, Jamaica, Bahamas, Brazil, Surinam, Ghana, southern China.

Puccinia leveillei Mont. in Gay, Fl. Chil. 8:41,1852.

On *Geranium nepalense* R. Sweet, Damingshan, 1997 XII 21, J.Y. Zhuang 5726 (HMAS 77420).

Distr.: Europe, North America, South America, Russian Far East, China, India, Pakistan, Nepal.

Puccinia liberta F. Kern, Mycologia 11: 142, 1919.

On *Eleocharis dulcis* (N.L. Burmann) K.B. v. Trinius, Nanning, 1989 XII 22, C.Y. Lai (HMAS 60094).

Distr.: U.S.A., Cuba, Guatemala, Venezuela, Philippines, southern China.

Puccinia longinqua Cummins, Mycologia 43:91, 1951.

On *Phragmites* sp. Rong Xian, 1933 VIII 9, S.Y. Cheo 2413 (PUR). Distr.: southern China.

Puccinia minussensis Thüm. , Bull. Soc. Imp. Nat. Moscow 53:214, 1878.

On *Ixeris* sp.,Yongning, 1958 XII 6, Y.Z. Liu 2134(HMAS 49681).

On *Lactuca* sp., Nanning, 1958 IX 19, G.Z. Jiang 7, (HMAS 24524); Ningming, 1958 X 17, Z.C. Liang 1195(HMAS 49690).

Distr.: Europe, North America, Asia.

Puccinia miyoshiana Dietel, Bot. Jahrb. 27:569, 1899.

On *Spodiopogon sibiricus* K.B.v. Trinius, Ningming, 1956 X 14, Z.C. Liang 1104(HMAS 33380).

Distr.: Japan, China, Russian Far East.

Puccinia nakanishikii Dietel, Bot. Jahrb. 34:585, 1905.

On *Cymbopogon citratus* (DC.) O. Stapf, Ningming, 1958 X 24, Z.C. Liang 1046(HMAS 36598).

Distr.: Japan, China, Vietnam, India, Sri Lanka, Singapore, Philippines, Papua New Guinea, Congo, Kenya, South Africa, Uganda.

Puccinia neyraudiae Syd. & P. Syd. in Syd., P. Syd. & E.J. Butler, Ann. Mycol. 10:260, 1912.

On *Neyraudia reynaudiana* (Kunth) Y.L. Keng, Ningming, 1958 X 24, Z.C. Liang 1053(HMAS 34279).

Distr.: India, southern China.

Puccinia oahuensis Ellis & Everh., Bull. Torr. Bot. Club 22: 435, 1895.

On *Digitaria violascens* Link, Shangsi, 1997 XII 28, J.Y. Zhuang 5787(HMAS 77503).

Distr.: World-wide.

Puccinia purpurea Cooke, Grevillea 5:15, 1876.

On *Sorghum vulgare* Pers., Jingxi, 1958 XII 11, H.Y. Liu 2037(HMAS 34527); 1958 XII 12, H.Y. Liu 2340(HMAS 34526); 1958 XII 14, H.Y. Liu 2355(HMAS 25619); Debao, 1958 XII 15, Z.C. Liang 1957(HMAS 36613); 1958 XII 19, Z.C. Liang 1982(HMAS 36612); 1958 XII 24, Z.C. Liang 22027 (HMAS 36614); Ningming, 1958 IX 14, Z.C. Liang 1156(HMAS 25228); 1958 X 15, Z.C. Liang 1171(HMAS 31324); Shangsi, 1958 IX 9, Z.C. Liang 1817(HMAS 31323); Yongning, 1958 XII 1, Y.Z. Liu 2131(HMAS 56258).

Distr.: Worldwide.

Puccinia scleriicola Arthur, Mycologia 7: 232, 1915.

On *Scleria biflora* Roxb., Shangsi, 1997 XII 29, J.Y. Zhuang 5803(HMAS 77500).

On *Scleria levis* Retz., Shangsi, 1997 XII 27, J.Y. Zhuang 5770(HMAS 77498).

On *Scleria* sp., Shangsi, 1997 XII 28, J.Y. Zhuang 5774(HMAS 77499); Napo, 1998 I 10, J.Y. Zhuang 5908(HMAS 77501).

Distr.: Southern North America, West Indies, southern China.

Puccinia sorghi Schwein., Trans. Amer. Phil. Soc. II, 4: 295, 1832.

On *Zea mays* L., Ningming, 1958 X 12, Z.C. Liang 962(HMAS 25226); Pingxiang, 1958 X 19, Z.C. Liang (HMAS 25225); Shangsi, 1958 XI 9, Z.C. Liang 1816(HMAS 31767).

Distr.: World-wide.

Puccinia stenospora J.Y. Zhuang & S.X. Wei sp. nov. Fig. 1

Spermogonia, aecia et uredinia ignota. Telia hypophylla, sparsa, rotundata, ca. 0.2-0.5 mm diam., nuda, pulvinata, fusca vel atro-brunnea, subcompacta, peridia nulla. Teliosporae obovatae vel anguste oblongae, rectae vel leviter curvae, apice rotundatae vel obtusae, basi attenuatae vel raro rotundatae, medio leviter constrictae, 50-75(-80) × 12-18 μ m, membrana fusca, minute rugulosa vel fere laevigata, plus minusve sed interdum indistincte unilateraliter incrassata, partim 1.5-2.5 μ m crassa, partim 2.5-5 μ m incrassata, ad apicem 3.5-6 μ m crassa, porus superior apicalis vel subapicalis, inferior juxta septum situs, pedicellus tenuissimus, hyalinus, usque ad 50 μ m longus, collapsus. Sporae statim germinantes.

Hab. in foliis Machili parabreviflorae H.T. Chang in provincia Guangxi (Kwangsi) in montibus Shiwandashan prope oppidum Shangsi, 28 XII 1997, leg. J.Y. Zhuang, no.5784 (HMAS 77391, holotypus, in Herb. Mycol. Academiae Sinicae conservatus).

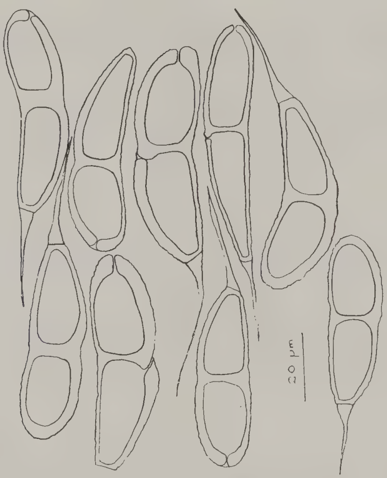

Fig. 1 Teliospores of *Puccinia stenospora* J.Y. Zhuang & S.X. Wei sp. nov. (HMAS 77391)

This rust is characterized by the fuscous teliospores with more or less unilaterally thickened side wall. The type specimens of lauracicolous species of *Puccinia* having teliospores with unilateral thickening of wall with which the present rust is compared are available. They are:

1. *Puccinia linderae-setchuenensis* J.Y. Zhuang, on *Lindera setchuenensis* Gamble, Sichuan: Wolong, 1 IX 1982, coll. B. Li, HMAS 44521 (type!).
2. *Puccinia machili* Cummins, on *Phoebe tavoyana* (Meissn.) Hook.f., Guangxi: Lingyun, 29 IV 1933, coll. S.Y. Cheo, PUR-F 11928 (type!).
3. *Puccinia morata* Cummins, on *Litsea elongata* (Wall. ex Nees) Benth. & Hook.f. var. *subverticillata* Y.C. Yang & P.H. Huang, Guangxi: Lingyun, 25 IV 1933, coll. S.Y. Cheo, PUR-F 11926 (type!).

4. *Puccinia scimitriformis* Cummins, on *Persea americana* Mill., Guangxi: Rong Xian, 23 VIII 1933, coll. S.Y. Cheo, PUR-F 11927 (type!)

These are found only in China. A comparison of these with our collection confirmed that the rust is an undescribed one. Because of the similarity in measurements and shape, the teliospores of the rust and those of *Puccinia scimitriformis* are nearly indistinguishable. However in *P. scimitriformis* the spores are slimmer (60-90×12-15 μ m), the unilateral thickening of the wall is much pronounced, and the curvature of the spores is more conspicuous (Cummins, 1949). *P. linderae-setchuenensis* is also similar to the rust in teliospore shape but its teliospores are much larger (65-115×17-28 μ m) and the walls are much thicker (2-3 μ m at thin side, 2.5-7.5 μ m at thick side, 7.5-12 μ m at apex) (Zhuang , 1990). *P. machili* and *P. morata* show resemblance to a certain extent. However, the following differences are sufficient to distinguish our new species from the two: (1) The shorter teliospores, in no case longer than 80 μ m. (2) The much thinner apical wall of spores, maximum thickness being 6 μ m. (3) The shorter and collapsing pedicels, maximum length probably being 50 μ m. (4) The slight curvature of spores.

Pucciniastrum agrimoniae (Dietel) Tranzschel, Script. Bot. Hort. Univ. Petropol. 4:301, 1895.

Thekopsora agrimoniae Dietel, Hedwigia 29:152, 1890.

On *Agrimonia pilosa* K.F.v. Ledeb. Nanning, 1997 XII 24-25, J.Y. Zhuang 5739 (HMAS 77429), 5752 (HMAS 77430); Shangsi, 1997 XII 31, J.Y. Zhuang 5837 (HMAS 77451).

Distr.: Europe, Asia, North America.

Sphaerophragmium acaciae (Cooke) Magnus, Ber. Deut. Bot. Ges. 9: 121, 1891.

Triphragmium acaciae Cooke, Grevillea 8:94, 1880.

On *Albizzia kalkora* (Roxb.) Prain, Shangsi, 1997 XII 28, J.Y. Zhuang 5792 (HMAS 77417), 1997 XII 29, J.Y. Zhuang 5805 (HMAS 77416).

On *Albizzia lebbeck* (L.) Benth., Shangsi, 1958 XI, Z.C. Liang 1898(HMAS 39893).

Distr.: Tropical Asia, Tropical Africa, Australia, Mexico, Puerto Rico, Brazil.

Tranzschelia pruni-spinosae (Pers.) Dietel, Ann. Mycol. 20:31, 1922.

Puccinia pruni-spinosae Pers., Synopsis Methodica Fungorum, p.226, 1801.

On *Prunus persica* (L.) Batsch, Jingxi, 1958 XII 14, H.Y. Liu 2354 (HMAS 25683); Ningming, 1958 X 22, Z.C. Liang 1300 (HMAS 25230); Yongning, 1958 XII 28, Y.Z. Liu 2106(HMAS 56775); Daxin, 1958 XII 18, Y.Z. Liu 2166 (HMAS 34542).

On *Prunus salicina* Lindl., Ningming, 1958 22, Z.C. Liang 1304(HMAS 74563).

On *Prunus* sp., Daxin, 1958 XII 18, Y.Z. Liu 2165 (HMAS 34544).

Distr.: Worldwide.

Uredinopsis pteridis Dietel & Holw. in Dietel, Ber. Deutsch. Bot. Gas. 13:331, 1895.

On *Pteridium aquilinum* (L.) Kuehn var. *latiusculum* (A.N. Desvaux) L.M. Underwood, Shangsi , 1997 XII 27, J.Y. Zhuang 5766 (HMAS 77452); 1997 XII 29, J.Y. Zhuang 5796 (HMAS 77453), 5808 (HMAS 77454), 5833 (HMAS 77455); 1998

I 2, J.Y. Zhuang 5862 (HMAS 77412), 5876 (HMAS 77456).

Distr.: Europe, North America, South America, Africa, Siberia, Japan, Korea, China, Nepal.

Uredo paederiae Syd. & P. Syd., Oesterr. Bot. Zeitschr. 52:184, 1902.

On *Paederia scandens* (J. de Loureiro) E.D. Merrill, Nanning，1997 XII 24, J.Y. Zhuang 5741 (HMAS 77407), 5745 (HMAS 77457); 1998 I 4, J.Y. Zhuang 5883 (HMAS 77458); Shangsi, 1997 XII 27, J.Y. Zhuang 5768 (HMAS 77408); 1998 I 2, J.Y. Zhuang 5871 (HMAS 77409).

Distr.: Comores, India, Japan (Okinawa), southern China.

Uredo tenuis (Faull) Hirats. f., Trans. Mycol. Soc. Japan 5:3, 1957.

Milesia tenuis Faull, Contrib. Arnold Arboretum, Harvard Univ. 2:74, 1932.

On *Nephrolepis auriculata* (L.) Trimen, Shangsi, 1998 I 2, J.Y. Zhuang 5865 (HMAS 77413); Damingshan, 1997 XII 19, J.Y. Zhuang 5713 (HMAS 77414).

Distr.: Philippines, Japan, southern China.

Uromyces appendiculatus (Pers.) Unger, Einfl. Bodens p. 216, 1836.

Uredo appendiculata var. *phaseoli* Pers., Synopsis Methodica Fungorum, p.222, 1801 (based on telia).

On *Phaseolus* sp.. Ningming, 1958 X 8, Z.C. Liang 898(HMAS 35481).

Distr.: Worldwide.

Uromyces bidenticola Arthur, Mycologia 9:71, 1917.

On *Bidens pilosa* L., Shangsi, 1998 I 2, J.Y. Zhuang 5869 (HMAS 77484).

Distr.: southern North America, West Indies, Central and South America, Africa, Asia.

Uromyces capitatus Syd. & P. Syd., Oesterr. Bot. Zeitschr 52:182, 1902.

On *Desmodium* sp., Ningming, 1958 X 8, Z.C. Liang 890(HMAS 31475).

Distr.: southern China, India.

Uromyces commelinae Cooke, Trans. Roy. Soc. Edinb. 31:342, 1888.

On *Commelina* sp., Rong Xian, 1933 VIII 10, S. Y. Cheo 2367 (HMAS 14701).

Distr.: Africa, southern North America, Central America, South America, India, Japan, southern China.

Uromyces cucullatus Syd. & P. Syd., Ann. Mycol. 2: 349, 1904.

On *Wedelia wallichii* C.F. Lessing, Shangsi, 1997 XII 31, J.Y. Zhuang 5849 (HMAS 77390).

Distr.: Mexico, Costa Rica, Panama.

Uromyces kwangsianus Cummins, Mycologia 43:80, 1951.

On *Fimbritylis* sp., Rong Xian, 1933 X 14, S.Y. Cheo 2888 (PUR-F 14252, type).

Distr.: southern China.

Uromyces mucunae Rabenh., Hedwigia 17: 62, 1878.

On *Stizolobium capitatum* (R. Sweet) Kuntze, Shangsi, 1958 XI 14, Z.C. Liang 1836(HMAS 35464).

On *Stizolobium deeringianum* K.S. Bort, Yongning, 1958 XII 5, Y.Z. Liu 2129(HMAS 44534).

Distr.: India, southern China.

Uromyces tenuicutis McAlpine, The Rusts of Australia , p. 87, 1906.

On *Sporobolus indicus* (L.) R. Br. var. *purpurea-suffusus* (Ohwi) T. Koyama, Shangsi, 1997 XII 28, J.Y. Zhuang 5786(HMAS 77504), 1997 XII 29, J.Y. Zhuang 5804(HMAS 77505).

Distr.: circumglobal in the warmer regions.

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Wang, Y.C. 1951. Index Uredinearum Sinensium. Academia Sinica, Beijing. 1-155.

Zhuang, J.Y. 1990. *Puccinia* species on Lauraceae: additions and notes on known species. *Mycosystema* 3:29-41.

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FUNGAL FLORA OF TROPICAL GUANGXI, CHINA: USTILAGINALES[1]

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ABSTRACT Twelve species belonging to 5 genera of the Ustilaginales are reported from tropical Guangxi, including a new species, *Sporisorium apludae-muticae* on *Apluda mutica*, and a species new to China, *Ustilago neyraudiae* Mundkur on *Neyraudia reynaudiana*.

摘要 广西热带的黑粉菌过去报道很少，菌物标本馆(HMAS)保藏的已定名黑粉菌标本仅有两个种。1997年12月下旬至1998年1月中旬，作者参加了中国科学院微生物研究所菌物科考队，在这一地区进行了黑粉菌标本的采集。经研究这些标本和菌物标本馆保藏的标本，有黑粉菌5属12个种，包括2个新种和1个中国新记录种，新种是寄生在白健秆[*Eulalia pallens* (Hack.) Kuntze]植物上的广西孢堆黑粉菌(*Sporisorium guangxiense* L. Guo) (Guo, 1999)和寄生在水蔗草(*Apluda mutica* L.)植物上的球孢堆黑粉菌(*Sporisorium apludae-muticae* L. Guo)，中国新记录种是寄生在类芦[*Neyraudia reynaudiana* (Kunth) Keng]植物上的类芦黑粉菌(*Ustilago neyraudiae* Mundk.)。

Smut fungi from the tropical region of Guangxi Province in the south of China were rarely recorded. Only 2 species of smut fungi from the region were kept in "Herbarium Mycologicum Instituti Microbiologi Academiae Sinicae" (HMAS). During a mycological expedition to the region from December 1997 to January 1998, some specimens of smut fungi were collected by the author and her colleagues. These materials were identified together with those specimens deposited in HMAS. Twelve species belonging to 5 genera of the Ustilaginales are reported. Among them, one new species, *Sporisorium guangxiense* L. Guo on *Eulalia pallens* (Hack.) Kuntze (Guo, 1999) was discovered as an unidentified specimen in HMAS. Another new species, *Sporisorium apludae-muticae* L. Guo on *Apluda mutica* L. and a species new to China, *Ustilago neyraudiae* Mundk. on *Neyraudia reynaudiana* (Kunth) Keng are proposed. These species are listed as follows.

Farysia butleri (Syd. & P. Syd.) Syd. & P. Syd., Ann. Mycol. 17:42, 1919.

On *Carex cruciata* Wall., Guangxi: Shangsi, 2. I. 1998, Guo L, Guo SY 1586, HMAS 77301; Napo, 10. I. 1998, Guo L 1619, HMAS 77296.

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Sphacelotheca hydropiperis (Schumach.) de Bary, Vergleichende Morphologie und Biologie der Pilze, Mycetozoen und Bacterien. p. 187, 1884.

On *Polygonum hydropiper* L., Guangxi: Napo, 11. I. 1998, Guo L 1610, HMAS 77294.

On *Polygonum jucundum* Meisn., Guangxi: Napo, 10. I. 1998, Guo L 1609, HMAS 77303.

On *Polygonum posumbu* Hamilt ex D. Don, Guangxi: Napo, 10. I. 1998, Guo L 1618, HMAS 77295.

Sporisorium apludae-muticae L. Guo, sp. nov. (Figs. 1-2)

Sori in all spikelets of an inflorescence, cylindrical, 15-30 x 0.8-2 mm, at first covered by a brownish peridium which ruptures irregularly disclosing the blackish-brown, powdery spore mass. Columella single. Spore balls ovoid, subglobose, ellipsoidal, elongated to irregular, 50-200 x 35-140 µm, dark reddish-brown. Ustilospores subglobose, ovoid, ellipsoidal, polyhedral or irregular, 7-13 (-15) x 6-11.5 µm, wall often unevenly thickened. Outer spores dark reddish-brown; wall 1-2 µm, echinulate on their free surface with spines ca. 0.5 µm. Inner spores pale yellowish- brown; wall 0.5-1 µm, finely echinulate, smooth on their contact sides.

Sori in omnibus spiculis inflorescentiae, cylindrici, 15-30 x 0.8-2 mm, primo peridio brunneolo cooperti, illo irregulariter disrupto massam atrobrunneam, pulveream sporarum ostendentes. Columella solitaria. Glomeruli sporarum ovoidei, subglobosi, ellipsoidales, elongati vel irregulares, 50-200 x 35-140 µm, atro-rufobrunnei. Ustilosporae subglobosae, ovoideae ellipsoidales, polyedricae vel irregulares, 7-13 (-15) x 6-11.5 µm; pariete saepe inaequali. Sporae externae atro-rufobrunneae; pariete superficiei liberae 1-2 µm crasso, echinulato. Sporae internae pallide flavo-brunneae; pariete 0.5-1 µm crasso, subtiliter echinulato, pariete laterum contingentium levi.

On *Apluda mutica* L., Guangxi: Pingxiang, 6. I. 1998, Guo L 1622, HMAS 77290 (Holotype).

Sporisorium apludae-aristatae (Patil & Thirum.) Vánky, which has dense and prominent spines up to 1-1.5 µm on the free surface of the outer spores (Vánky, 1997), differs from *Sporisorium apludae-muticae* L. Guo.

Sporisorium formosanum (Sawada) Vánky, Publ. Herb. Univ. Uppsala 11:12, 1983.

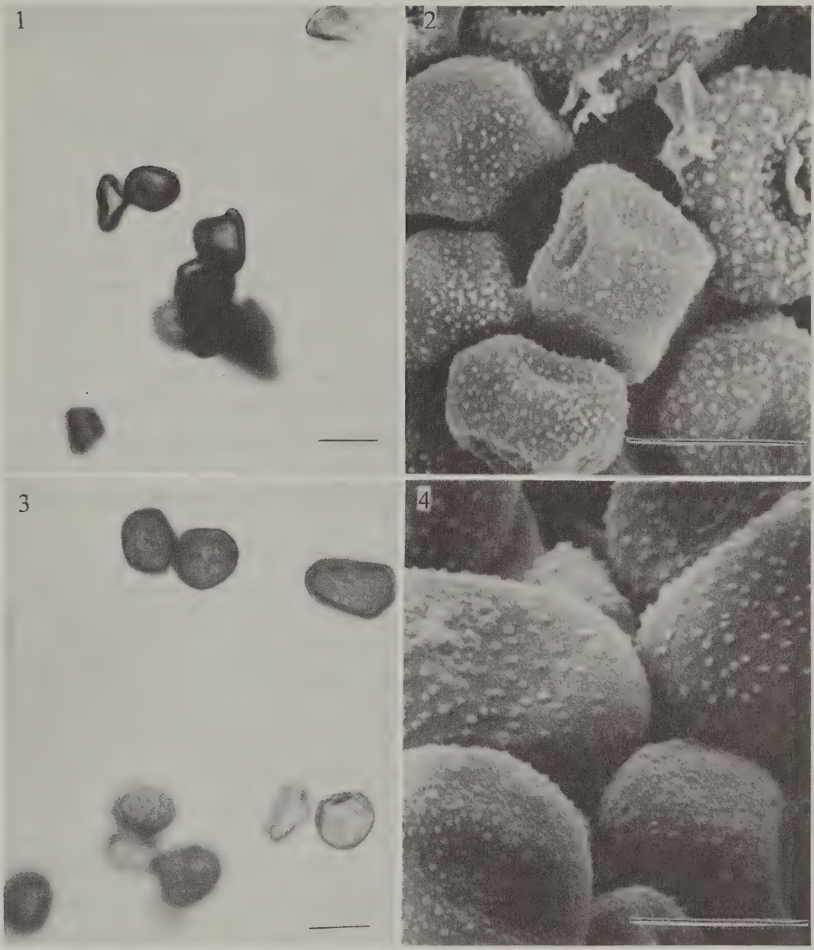
On *Panicum repens* L., Guangxi: Nanning, 5. I. 1998, Guo L 1597, HMAS 77291.

Sporisorium guangxiense L. Guo, Mycosystema 18(3): (in press), 1999.

On *Eulalia pallens* (Hack.) Kuntze, Guangxi: Shangsi, 15. XI. 1958, Liu HY 400, HMAS 74197.

Sporisorium tanglinense (Tracy & Earle) L. Guo, Mycosystema 3:85, 1990.

On *Ischaemum indicum* (Houtt.) Merr., Guangxi: Napo, XI. 1988, Yan LC 1542, HMAS 77423.



Figs. 1-2. Ustilospores of *Sporisorium apludae-muticae* L. Guo in LM and SEM (Holotype). Bars=11 μm and 6 μm respectively. Figs 3-4. Ustilospores of *Ustilago neyraudiae* Mundk. in LM and SEM. Bars=11 μm and 5 μm respectively.

Tolyposporium triste Vánky, Mycotaxon 62:154, 1997.

On *Gahnia tristis* Nees, Guangxi: Shangsi, 1. I. 1998, Guo L 1578, HMAS 77300.

Ustilago cordae Liro, Ann, Acad. Sci. Fenn. A, 17:12, 1924.

On *Polygonum posumbu* Hamilt ex D. Don, Guangxi: Napo, 10. I. 1998, Guo L 1608, HMAS 77305; Napo, 11. I. 1998, Guo L 1617, HMAS 77293.

Ustilago cynodontis (Henn.) Henn., Bull. Herb. Boissier 1:114, 1893.

On *Cynodon dactylon* (L.) Pers., Guangxi: Ningming, 7. X. 1958, Liang ZC 859, HMAS 52044; Nanning, 15. I. 1998, Guo L 1599, HMAS 77289; Nanning, 15. I. 1998, Guo L 1596, HMAS 77302.

Ustilago neyraudiae Mundk., Trans. Brit. Mycol. Soc. 24:323, 1940. (Figs. 3-4)

Sori in a few ovaries, ovoid or ellipsoidal, 1.5-2 mm long, 0.8-1.2 mm wide, at first covered by a green membrane. Spore mass black, agglutinated to powdery. Ustilospores subglobose, ovate, ellipsoidal or irregular, 8.5-12.5(-17.5)×7.5-11µm, dark reddish-brown or yellowish-brown, echinulate, under SEM verruculose between the spines.

On *Neyraudia reynaudiana* (Kunth) Keng, Guangxi: Shangsi, 29. XII. 1997, Guo L 1537, HMAS 77304; Pingxiang, 6. I. 1998, Guo L 1601, HMAS 77464.

Ustilago reticulata Liro, Ann. Acad. Sci. Fenn, A, 17:20, 1924.

On *Polygonum lapathifolium* L., Guangxi: Napo, 10. I. 1998, Guo L 1602, HMAS 77297.

Ustilago scitaminea Syd., Ann. Mycol. 22:281, 1924.

On *Sacchrum officinarum* L., Guangxi: Ningming, 7. X. 1958, Liang ZC 848, HMAS 31419.

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MYCOTAXON

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FUNGAL FLORA OF TROPICAL GUANGXI, CHINA: A SURVEY OF MYXOMYCETES FROM SOUTHWESTERN GUANGXI [*]

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ABSTRACT Sixty taxa of myxomycetes from tropocal Guangxi are reported in the present paper. Among them, one is proposed as new species; *Comatricha nutans*, and three are new records to China, namely *Arcyria brunnea*, *Didymium pertusum* and *Enteridium splendens* var. *juranum*.

KEY WORDS Myxomycetes; Tropical Guangxi; *Comatricha nutans*

The Guangxi Zhuang Autonomous Region lies between 20° 54 ´N and 26°20 ´ N latitude. About half of the area is to the south of Tropic of Cancer. Considering the diversity of vegetation and environmental conditions in tropical Guangxi, abundant myxomycetes would be expected. Unfortunately, only 19 species of myxomycetes were noted from the province prior to this study (Teng, 1963).

The present paper is based on myxomycete specimens from field collections during a tropical mycological expedition in several sites of southwestern Guangxi (Nov., 1997—Jan., 1998) and in moist chamber cultures. Sixty taxa belonging to six orders were recognized, of which one is new to science, three are new records to China (marked with an asterisk), and forty-seven are new to Guangxi. Synonyms are given when name changes are needed for species reported previously from China. The systematic treatment by Martin and Alexopoulos (1969) is chiefly followed. All the specimens examined are deposited in the Herbarrium Mycologicum Instituti Microbiologici Academiae Sinica (HMAS).

SPECIES LIST

Ceratiomyxales

Ceratiomyxa fruticulosa (O. F. Müll.) Macbr., N. Am. Slime-Moulds 18, 1899

Shangsi: Shiwandashan, HMAS 72357, 72354; Shangsi: Mt. Dalongshan 72510, 72515, 72530, 72541.

Liceales

Cribraria confusa Nann.-Bremek. & Y. Yamam., Proc. K. Ned. Akad. Wet. Ser. C 86:

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[*] Supported by the National Natural Science Foundeation of China (No. 39730020)

212, 1983

Shangsi: Pingguang Forest Center, HMAS 74793.

Cribraria microcarpa (Schrad.) Pers., Syn. Fung. 190, 1801. emend. Nann.-Bremek., Proc. K. Ned. Akad. Wet. Ser. C 69: 340, 1966

Shangsi: Pingguang Forest Cen ter, HMAS 74793, 75041.

Cribraria minutissima Schwein., Trans. Am. Phil. Soc. II. 4: 260, 1832

Shangsi: Pingguang Forest Center, HMAS 74763.

Dictydiaethalium plumbeum (Schumach.) Rostaf., Versuch 5, 1873

Nanning: Liangfengjiang Garden, HMAS 72382, 74771, 74803, 74804; Shangsi: Pingguang Forest Center, 72509.

Dictydium cancellatum (Batsch) T. Macbr., N. Am. Slime-Moulds 172, 1899

Wuming: Mt. Damingshan, HMAS 72449; Pingxiang, 68697; Shangsi: Pingguang Forest Center, 72491, 72522; Shangsi: Shiwandashan, 72418.

Enteridium lycoperdon (Bull.) M. L. Farr, Taxon 25: 514, 1976

Wuming: Mt. Damingshan, HMAS 72383, 72400.

**Enteridium splendens* (J. B. Morgan) T. Macbr. var. *juranum* (Meyl.) Härk., Karstenia 19: 5, 1979

Wuming: Mt. Damingshan, Guangxi. HMAS 72388, 72401. On rotten wood.

Licea operculata (Wingate) G. W. Martin, Mycologia 34: 702, 1942

Wuming: Mt.Damingshan, HMAS 74792.

Lycogala epidendrum (L.) Fr., Syst. Myc. 3: 80, 1829.

Wuming: Mt. Damingshan, HMAS 72432, 72436, 72427, 72381, 72443, 72399, 72378, 72445, 72450, 72451, 72384, 72430; Shangsi: Shiwandashan, HMAS 72392, 72372.

Echinosteliales

Clastoderma debaryanum A. Blytt, Bot. Zeit. 38: 343, 1880

Wuming: Damingshan 74785, 74790, 74772; Shangsi: Pingguang Forest Center, HMAS 68698, 74777, 63281, 63313, 74768.

Echinostelium minutum de Bary, in Rostaf., Mon. 215, 1874

Wuming: Mt. Damingshan, HMAS 74788, 74792, 63316; Shangsi: Pingguang Forest Center, HMAS 74781, 75085.

Trichiales

**Arcyria brunnea* Nann.-Bremek. & Y. Yamam., Proc. K. ned. Akad. Wet. Ser. C 89: 219, 1986

Wuming: Mt. Damingshan, HMAS 75022. On dead wood.

Arcyria cf. *cinerea* (Bull.) Pers.

Shangsi: Pingguang Forest Center, HMAS 63310, 63311, 63313, 75044.

Four specimens of *Arcyria* were obtained from living barks of *Larix* spp. in moist chamber culture. They undoubtedly resemble *Arcyria cinerea* (Bull.) Pers., but differ in sporangia solitary, white to bluish grey; ornaments of capillitia sparse and even spinules. Pure white or bluish grey sporangia of *A. cinerea* have never been seen by the author in the field, and typical *A. cinerea* also emerged at the same time on bark samples in other moist chambers. They are not fully identical with *A. cinerea* (Bull.) Pers.

Arcyria cinerea (Bull.) Pers., Syn. Fung. 184, 1801

Wuming: Mt. Damingshan, HMAS 72394; Shangsi: Shiwandashan, 72409; Shangsi: Pingguang Forest Center, 72426, 72505, 72547, 75045, 75046, 75052.

Arcyria denudata (L.) Wettst., Verh. Zool.-Bot. Ges. Wien. 35: Abh. 535, 1886

Shangsi: Shiwandashan, HMAS 72370, 72385, 72447, 72424, 72373; Wuming: Mt. Damingshan 72441, 75053.

Arcyria globosa Schwein., Schrad. Nat. Ges. Leipzig 1: 64, 1822

Shangsi: Mt. Pinglongshan, HMAS 72524.

Arcyria incarnata (Pers.) Pers., Obs. Myc. 1: 58, 1796

Wuming: Mt. Damingshan, 72437.

Arcyria minuta Buchet, in Pat., Mem. Acad. Malgache 6: 42, 1927

Arcyria carnea (G. Lister) G. Lister, Jour. Bot. 59: 92, 1921

Shangsi(上思): Pingguang Forest Center, HMAS 72542.

Hemitrichia calyculata (Speg.) M. L. Farr, Mycologia 66: 887, 1974

Napo: Nonghua HMAS 72469; Wuming: Mt. Damingshan, 72389.

Hemitrichia serpula (Scop.) Rostaf., in Lister, Mycet. 179, 1894

Shangsi: Shiwandashan, HMAS 72387; Nanning, 72386, 72374, 72368, 72411, 72421; Wuming: Mt. Damingshan, 72375; Napo: Nonghua, 72474, 72502; Shangsi: Pingguang Forest Center, 72486, 72528.

Perichaena chrysosperma (Curr.) Lister, Mycet. 196, 1894

Shangsi: Pingguang Forest Center, HMAS 72514, 72548; Pingxiang, 72526, 68693, 72499, 72507.

Perichaena corticalis (Batsch) Rostaf., Mon. 293, 1875

Pingxiang, HMAS 68696.

Perichaena depressa Lib., Pl. Crypt. 378, 1837

Nanning: Guangxi Medicinal Garden, HMAS 72421, 72405, 72393, 72419, 74776, 74780, 74794, 63292; Shangsi: Pingguang Forest Center, 72500, 72519, Pingxiang, 72493; Napo: Defu, 72479, Pingxiang, 72549.

Perichaena vermicularis (Schwein.) Rostaf., Mon. App. 34, 1876

Shangsi: Pingguang Forest Center, HMAS 72495.

Trichia botrytis (J. F. Gmel.) Pers., Neues Mag. Bot. 1: 89, 1794

Shangsi: Pingguang Forest Center, HMAS 74778, 74767, 74787, 74795, 74796, 74800, 63280; Wuming: Mt. Damingshan, 74779

Trichia decipiens (Pers.) T. Macbr., N. Am. Slime-Moulds 218, 1899

Shangsi: Pingguang Forest Center, HMAS 72529.

Trichia favoginea (Batsch) Pers., Neues Mag. Bot. 1:90, 1894

Wuming: Mt. Damingshan, HMAS 72395, 72408; Shangsi: Shiwandashan, 72369; Nanning, 72404.

Farr (1958) listed *T. affinis* de Bary and *T. persimilis* P. Karst. as synonyms of *T. favoginea* (Batsch) Pers. Martin and Alexopoulos (1969) followed her. But Nannenga-Bremekamp (1974) and Thind (1977) recognized them as distinct species. Whatever their taxonomic status, *T. affinis* and *T. persimilis* are separate species closely related to *T. favoginea*. Although some specimens from tropical Guangxi seem to be *T. affinis* or *T. persimilis*, I prefer to treat them as *T. favoginea*.

Stemonitales

Comatricha elegans (Racib.) G. Lister, Guide Brit. Mycet. ed.3. 31, 1909

Nanning: Qingxiushan Garden, HMAS 72477, 72482.

Comatricha nutans S. L. Chen **sp. nov.** Plate I

Sporangia stipitata, caespitosa ad gregaria, globosa, nutantia, brunnea vel fusca, 0.4—0.7 mm in diam., 2.5—3.2 mm alta. Peridium mox omnino evanescens. Stipes gracilis, subulatus, sursum contractus, curvus, circiter 4/5 ad 5/6 alti toti aeguans, 2.0—2.6 mm longus, furcus, deorsum dilutescens, basi rubido-brunneus, politus, fere glabratus, inconspicue vittatus, intra fibratus et basi reticulatus, vulgo inter binos sporangii ad contiguus basim vel 1/3 inferne connatus, stipes unicus membranis hyalinis praeditus, aliquot solitarius saliquot 3 ad 4 sporangii connatus, basi in hypothallo expansus. Hypothallus membranaceus, brunneolus, sporangiis communiter unitus. Columella curta, infra centrum sporangii cava. Capillitium dense reticulatum, rami primarii ex a columellae orientes et tum multo ramificantes anastomosantesque, extremitatibus liberis paucis et curtis, filum brunneum et flexuosum, protuberationes multas parvas irregulares gerens. Sporae per saturam brunneae, luce transmissa griseo-brunneae, aequaliter et subtiliter punctulatae, parte parva et diluta praeditae, globosae, 7.2—8.3 μm diam. Aphanoplasmodium fere incoloratum.

Habitat ad corticem *Cinnamomi* vivum in culturis, mons Damingshan, Guangxi, Sina.

Sporangia stipitate, caespitose to gregarious, globose, nodding, brown or fuscous, 0.4—0.7 mm in diameter, 2.5—3.2 mm in total height. Peridium evanescent. Stalks slender, subulate, tapering upwards, curved, 2.0—2.6 mm in length, about four-fifth to five-sixth the total height, blackish brown, becoming paler downwards, reddish brown at base; polished, nearly smooth, with faint longitudinal stripes, fibrous inside and reticulate at base; usually connate at the bases or below one-third of the stalks in two adjacent sporangia, the separated part of uniting stalks having hyaline membranous expansions, few solitary and few connate in 3-4 sporangia; expanded at the base into a hypothallus. Hypothallus membranous, light brown, irregularly rounded, common to connate sporangia. Columella short, below the center of the sporangium cavity. Capillitium forming a dense network, the primary branches mainly arising from the upper parts of the columella, then branching many times and anastomosing, free ends few and short, threads brown and flexuous, bearing many small, dark, irregular protrusions. Spores brown in mass, pale grayish brown by transmitted light, evenly and minutely punctuate, with a small pale part, globose, 7.2—8.3 μm diameter. Aphanoplasmodium nearly colourless.

Holotype: Chen Shuang-lin CMC 04-2 (HMAS 75023). On living bark of *Cinnamomum* spp. and moss on bark in moist chamber. Dec. 19, 1997. Cultured on Mar. 6, 1998. Harvested on Apr. 13, 1998.

Type locality: Wuming: Mt. Damingshan, Guangxi, China.

Etymology: From the Latin “nutans”, referring to the nodding sporangia.

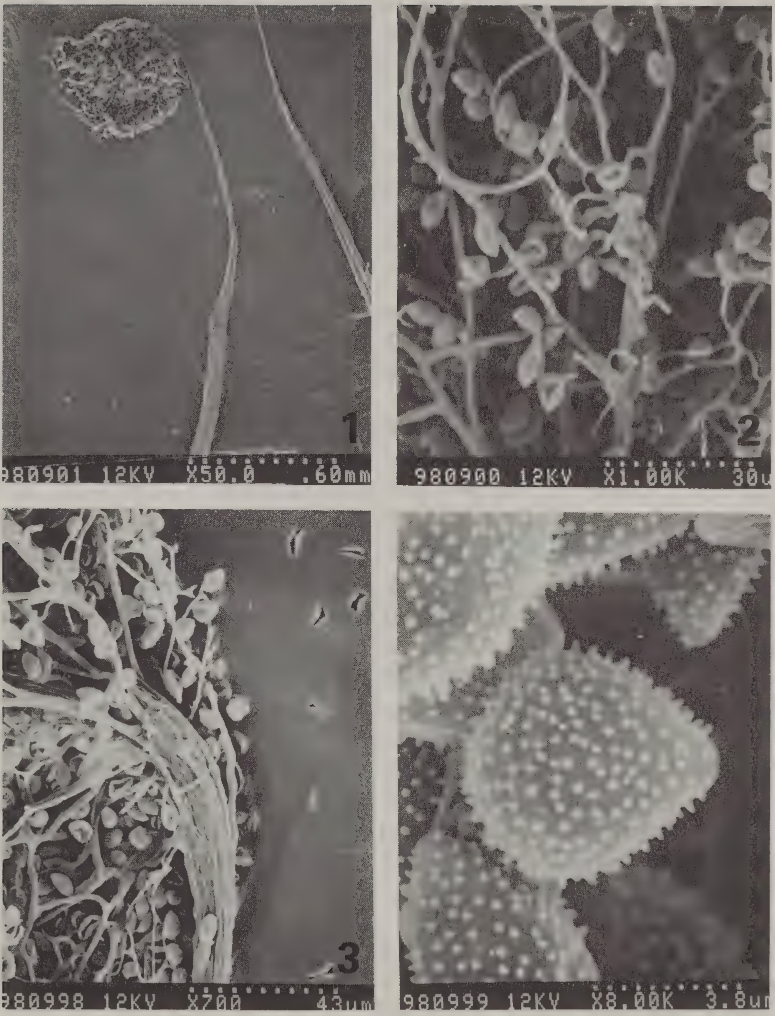
1
980901 12KV X50.0 .60mm
2
980900 12KV X1.00K 30u
3
980998 12KV X700 43um
980999 12KV X8.00K 3.8u

Plate I. *Comatricha nutans* sp. nov. 1. A stalked sporangium; 2. Detail of capillitium with small protrusions; 3. Columella and primary branches of capillitium; 4. Spores

Distribution: Known only from the type locality.

Comatricha nutans has globose sporangia and long stalks that make it group with *C. elegans* (Racib.) G. Lister, *C. ellae* Härk. and *C. nigra* (Pers.) J. Schröt. From the first it differs in denser and thicker capillitium, smaller spores (7.2—8.3 μm/8—10 μm) with a small paler part; from the second in larger sporangia (0.4—0.7 mm× 2.5—3.2 mm/0.2—0.4 mm×0.6—1.0 mm), shorter columella and absence of surface net; from the third in smaller spores (7.2—8.3 μm/9—10 μm), shorter columella and primary branches of capillitium not from all parts but from the upper parts of the columella.

This species is characterized by the combination of nodding sporangia, connate stalks and dark capillitium with small irregular protrusions.

Comatricha typhoides (Bull.) Rostaf., in Lister, Mycet. 120, 1894

Shangsi: Shiwandashan, HMAS 72398.

Lamproderma arcyrionema Rostaf., Mon. 208, 1874

Shangsi: Pingguang Forest Center, HMAS 68690, 68692, 68698, 72485, 72490, 72498, 72506, 72512, 72520, 72521, 72525, 72534, 72536, 72537, 72540.

Lamproderma scintillans (Berk. & Broome) J. B. Morgan, Jour. Cinc. Soc. Nat. Hist. 16: 131, 1894

Wuming: Mt. Damingshan, HMAS 72355, 72444, 72406, 72371, 72377, 72442, 72397, 75054; Shangsi: Pingguang Forest Center, HMAS 72517.

Stemonitis fusca Roth, Mag. Bot. Romer & Usteri 1(2): 26, 1787

Wuming: Mt. Damingshan, HMAS 72446, 72403, 71481; Shangsi: Pingguang Forest Center, 72506; Pingxiang, 72544.

Stemonitis herbatica Peck, Ann. Rep. N. Y. State Mus. 26: 75, 1874

Shangsi: Pingguang Forest Center, HMAS 72496, 72501, 72546.

Stemonitis nigrescens Rex, Proc. Acad. Phila. 43: 392, 1891

Shangsi: Shiwandashan, HMAS 72409, 72376.

Stemonitis pallida Wingate, in T. Macbr., N. Am. Slime-Moulds 123, 1899

Shangsi: Shiwandashan, HMAS 72356.

Stemonitis smithii T. Macbr., Bull. Nat. Hist. Univ. Iowa 2: 381, 1893

Shangsi: Pingguang Forest Center, HMAS 72532.

Stemonitis splendens Rostaf., Mon. 195, 1874

Shangsi: Pingguang Forest Center, HMAS 72497, 72523, 72527.

Stemonitis virginiensis Rex, Proc. Acad. Phila. 43: 391, 1891

Wuming: Mt. Damingshan, HMAS 72420.

Physarales

Badhamia affinis Rostaf., Mon. 143, 1874

Pingxiang, HMAS 72472, 68695, 68696, 72470, 72475, 72480, 72507, 72511, 72538.

Badhamia gracilis (T. Macbr.) T. Macbr., in Macbride & Martin, Myxom. 35, 1934

Pingxiang, HMAS 68691, 72481, 72504, 72516; Shangsi: Mt. Pinglongshan, 72471, 72473, 72476, 72478, 72483.

Craterium leucocephalum (Pers.) Ditmar, in Sturm, Deuts. Fl. Pilze 1: 21, 1813

Wuming: Damingshan, HMAS 72414, 72407, 72402, 72425, 72431, 72413, 72415, 72390.

Diderma effusum (Schwein.) J. B. Morgan, Jour. Cinc. Soc. Nat. Hist.. 16: 155, 1894

Nanning, HMAS 63312.

Diderma floriforme (Bull.) Pers., Neues Mag. Bot. 1: 89, 1794

Wuming: Mt. Damingshan, HMAS 75051.

Didymium intermedium Schröt., in P. C. Hennings, Hedwigia 35: 209, 1896

Wuming: Mt. Damingshan, HMAS 75086.

Didymium iridis (Ditmar) Fr., Syst. Myc. 3: 120, 1829

Wuming: Mt. Damingshan, HMAS 63316; 72397.

Didymium minus (A. Lister) J. B. Morgan, Jour. Cinc. Soc. Nat. Hist. 16: 145, 1894

Shangsi: Shiwandashan, HMAS 72379, 72380; Wuming: Mt.Damingshan, 75054

Didymium nigripes (Link) Fr., Syst. Myc. 3: 119, 1829

Wuming: Mt. Damingshan, HMAS 72412; Shangsi: Pingguang Forest Center, HMAS 68694, 72484, 72489, 72533, 72535, 72539, 72543.

Didymium ovoideum Nann.-Bremek., Med. Bot. Mus. Herb. Utrecht 150: 780, 1858

Nanning: Qingxiushan Garden, HMAS 74784, 74789, 74798, 63282, 63283, 63284, 63285, 63286, 63287, 63288, 63289, 63290, 63291, 63293.

**Didymium pertusum* Berk., in Sm., English Fl. 5(2): 313, 1836

Mt. Damingshan, HMAS 75021. On dead leaves.

Didymium squamulosum (Alb. & Schwein.) Fr., Symb. Gast. 19, 1818

Wuming: Mt.Damingshan, HMAS 72396, 72435, 72410, 72422, 72433, 72448, 72434, 72428; Shangsi: Pingguang Forest Center, 72517.

Physarum crateriforme Petch, Ann. Bot. Garol. Peradeniya 4: 304, 1909

Nanning, HMAS 63312, 75042.

Physarum melleum (Berk. & Broome) Massee, Mon. 278, 1892

Wuming: Mt. Damingshan, HMAS 72440; Shangsi: Pingguang Forest Center, 72545.

Physarum nucleatum Rex, Proc. Acad. Phila. 43: 389, 1891

Shangsi: Shiwandashan, HMAS 72423, 72391.

Physarum nutans Pers., Ann. Bot. Usteri 15: 6, 1795

Wuming: Mt. Damingshan, HMAS 72429; Pingxiang, 72494, 72531; Napo: Nonghua, 72503.

Physarum pusillum (Berk. & M. A. Curtis) G. Lister, Mycet. ed. 2. 64, 1911

Wuming: Mt. Damingshan, HMAS 72416, 75043, 75083, 75084.

Physarum roseum Berk. & Broome, Jour. Linn. Soc. 14: 84, 1873

Wuming: Mt. Damingshan, HMAS 72438.

Physarum stellatum (Massee) G. W. Martin, Mycologia 56: 561, 1964

Physarum columbinum (Rostaf.) Sturgis, Mycologia 8: 201, 1916

Pingxiang, HMAS 72504.

Physarum viride (Bull.) Pers., Ann. Bot. Usteri 15: 6, 1795

Wuming: Mt. Damingshan, HMAS 72439, 72417.

DISCUSSION

In this mycological expedition to tropical Guangxi, 203 myxomycete specimens were collected in the field and 47 were obtained from the moist chamber culture from 26 samples of living bark. Of the 250 myxomycete specimens (Table 1), six are in the Ceratiomyxales(2.4%), 84 Physarales (33.6%), and specimens in other four orders range between 13 (5.2%) and 70 (28.0%). This result coincided more or less with the total number of species in the six orders of the Myxomycetes. Judged by the types of substrata of the six orders, the substrata of the Ceratiomyxales and Echinosteliales were comparatively uniform. Four of the six ceratiomyxalean specimens were collected on rotten wood and other two on litter; echinostelialean specimens were mainly found on living bark in moist chamber culture but two specimens of *Clastoderma debaryanum* A. Blytt on were withered twigs. The other four orders of were found on all different types of substrata.

Table 1. Number of myxomyxete specimens occurring on various substrata

Orders of	Types of substrata					
Myxomycetes	Rotten wood	Living bark	Dead bark	Living grass	Litter	Total
Ceratiomyxales	4				2	6
Echinosteliales		11			2	13
Liceales	17	8	7		1	33
Trichiales	26	19	23		2	70
Stemonitales	20	2	4	9	9	44
Physarales	11	7	23	10	33	84

Among the sixty taxa of myxomycetes from tropical Guangxi, one species is referred to Ceratiomyxales, nine to Liceales, two to Echinosteliales, sixteen to Trichiales, twelve to Stemonitales and twenty to Physarales. More work needs to be done and more slime moulds are expected to be discovered in Guangxi.

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中国广西热带地区的真菌：广西西南部粘菌资源的调查研究

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摘要：广西的西南部位于北回归线以南，属热带，对这一地区的粘菌从未有过专门的研究，在广西全境，此前也仅有 19 种粘菌被记载（邓叔群，1963），考虑到热带地区生物多样性的丰富度，显然可以期望自广西的热带地区获得更多的粘菌物种。作者在参加对该地区菌物的考察中（1997.12—1998.1），收集到 203 份粘菌标本和 26 份活树皮，经湿室培养又获得 42 份粘菌标本，目前从中明确了 60 个单元，它们分属于粘菌的 6 个目，其中垂头发菌 *Comatricha nutans* 为新种，褐色团网菌 *Arcyria brunnea* Nann.-Bremek. & Y. Yamam.、裂孔钙皮菌 *Didymium pertusum* Berk.和孔线膜菌网丝变种 *Enteridium splendens* Macbr. var. *juranum* Härk.为中国新记录种。本文以名录形式报告了这 60 个粘菌，对新种垂头发菌从形态学上进行了描述、图示和讨论，研究标本全部保存在中国科学院微生物研究所真菌标本馆(HMAS)。

关键词：粘菌，广西，垂头发菌

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TWO CREPIDOTUS FROM MEXICO WITH NOTES ON SELECTED TYPE COLLECTIONS

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Abstract: Mexican collections of *Crepidotus epibryus* (= *C. herbarum*) are reported, and some specimens from the USA treated by Hesler and Smith either as *C. herbarum* or *C. epybrius s.* Pilát are discussed. Also, the samples of *C. longicystis s.* Singer 1973 from Mexico are re-evaluated and found to be conspecific with the type collection of *Marasmiellus septicoides* (= *Crepidotus septicoides*) originally described from Brazil. In addition, a type study of *Crepidotus albatus* from USA is provided, and it is concluded that it is a synonym of the European *C. subverrucisporus*. Discussions, descriptions and illustrations of the microscopical features of the mentioned taxa are included.

Key words: *Crepidotus*, type study, taxonomy, Brazil, Mexico, USA.

In the contribution of Singer (1973) on *Crepidotus* from the neotropics, several new species and numerous reports from Mexico and South America were described. Most of those species, however, have not been mentioned again after their original description. This led us to consider the re-evaluation of the type collections and the re-examination of micromorphological characters of taxonomic relevance, which deserved additional observations that could be useful during the treatment of the specimens. In fact, some collections of species described by Singer that have been re-examined before, were found to be conspecific with previously described ones (e.g. *C. harperi* Singer, *C. luridus var minor* Singer) (Senn-Irlet, 1993; Singer, 1990). The characters of *Crepidotus* basidiospores, reveal important information within the genus (Pilát, 1948; Hesler and Smith, 1965; Singer, 1973; Nordstein, 1990; Senn-Irlet, 1995), and the pattern of the basidiospore ornamentation has been demonstrated to be consistent when analyzed under scanning electron microscope (Pegler and Young, 1972; Senn-Irlet, 1992b, 1993, 1995). Even the neotropical representatives could be grouped in categories based upon basidiospore ornamentation discerned (Senn-Irlet and De Meijer, 1998). The examination of some collections related with *C. epibryus* (Fr.: Fr.) Quél. s. Senn-Irlet, *C. verrucisporus* Pilát and *C. septicoides* (Singer) Singer showed interesting information which is discussed in this paper.

Microscopic analysis was carried out on sections mounted in 3% KOH and Congo red in 1% ammonia. Abbreviations used for the measurements of the basidiospores (25 per collection) are: $\bar{x}$= range of means of length and width of each collection; Q_m= range of means of the quotient Q (ratio of basidiospore length/basidiospore width); L (length), W (width) and Q represent the mean ± standard deviation of *n* collections. If there is a single collection then L, W and Q correspond to the mean of *n* basidiospores measured. Herbarium acronyms are according to Holmgren *et al.* (1990).

OBSERVATIONS ON THE SPECIES

1. ***Crepidotus epibryus* (Fr.: Fr.) Quél.**, Fl. Mycol Fr., p. 107, 1888.

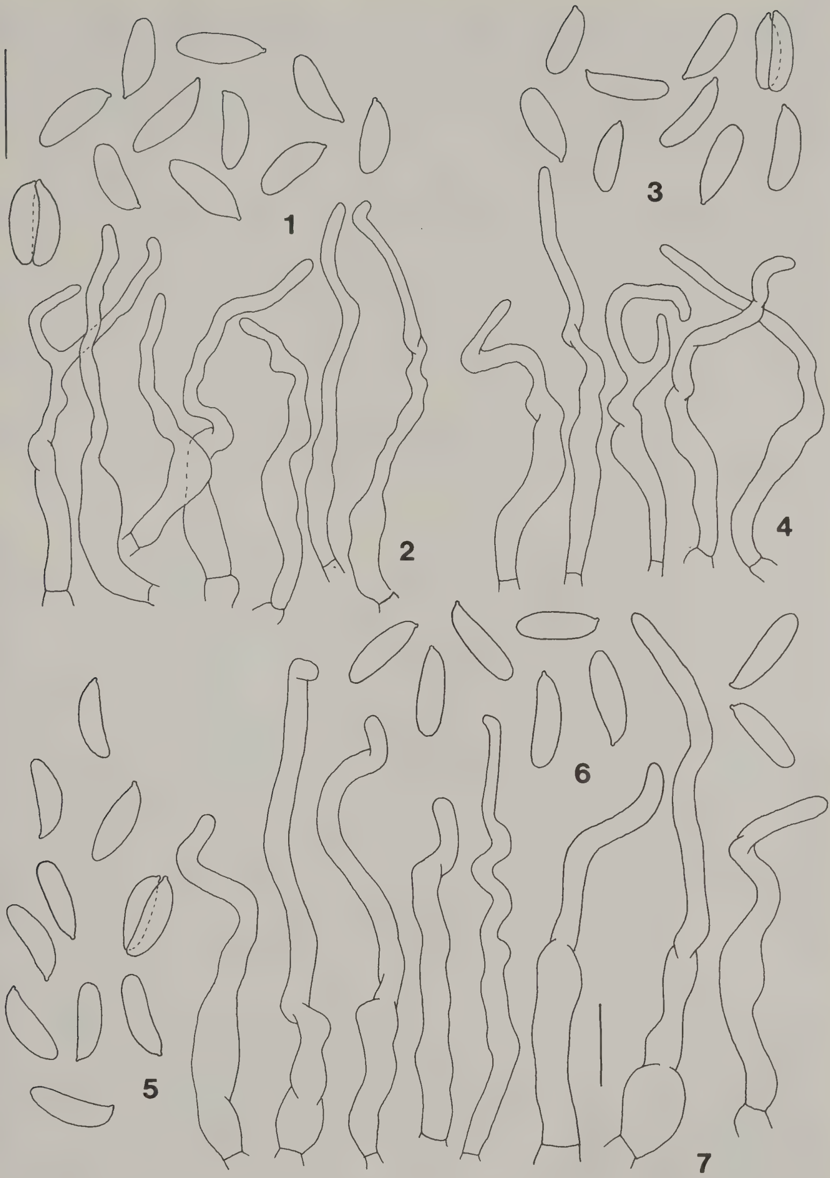
≡ *Agaricus epibryus* Fr.: Fr. Syst. Mycol. 1: 275, 1821.
= *A. herbarum* Peck, Bull. Buff. Soc. Nat. Sc. 1: 53, 1873.
= *Crepidotus herbarum* (Peck) Sacc., Syll. Fung. 5: 888, 1887.
= *Pleurotellus herbarum* (Peck) Singer, Lilloa 13: 84, 1947.
= *Agaricus hypnophilus* (Pers.) Berk., Outl. Brit. Fungol. 139, 1860.
= *Crepidotus hypnophilus* (Pers.) Nordstein, Syn. Fung. 2: 78, 1990.

Figs. 1-7

1.1. Description of Mexican collections:

Pileus 1-9 (-15) mm broad, often rather campanulate when young, becoming circular, semicircular or reniform, at times with an incision behind, finally more or less flabelliform, conchate, convex to rather plane, tomentose to fibrillose, somewhat velvety, margin incurved, smooth, surface white to whitish, in old specimens yellowish or beige. Lamellae white to cream, thin, close to subdistant, with white fimbriate edges. Sessile, at first almost dorsally attached, lateral with age, at times a rudimentary stipe present when young. Context white, thin.

Basidiospores 6-10 (-11) x (2-) 2.5-3.5 (-4) μm [$\bar{x}$= 7.5-8.8 x 2.8-3.1; Q_m= 2.5-2.9; L= 7.9 ± 0.86; W= 2.9 ± 0.28; Q= 2.7 ± 0.31, n= 9], cylindric to narrowly-ellipsoid, rarely ellipsoid, often rather curved in lateral view, with a weak suprahilar depression, commonly in tetrads and dyads, pale yellowish to yellowish or yellow, yellow in mass, smooth, thin-walled; under SEM the wall looks smooth (Figs. 30-32). Basidia 15-30 x 5-8 μm, 4-spored, clavate, hyaline. Cheilocystidia (14-) 25-80 (-87) x 2.5-6.5 (-7.5) μm, narrowly-lageniform to subcylindric-lageniform or somewhat fusoid, flexuous, contorted or coiled and then, somewhat whip-shaped, with a neck more or less long, slender and at times forked, (1-) 1.5-3.5 (-4) μm diam. at apex, numerous, projected above hymenium, rarely inconspicuous, hyaline, thin-walled, clampless. Pileipellis a cutis or a transition between a cutis and a trichoderm, with loosely interwoven, hyaline hyphae 2-6 μm diam., cylindric, often bifurcate, not gelatinized, terminal



Figs. 1-7.- Basidiospores and cheilocystidia of *Crepidotus epibryus*, 1-2: Bandala 2930-A; 3-4: Smith 55561; 5: Peck s.n. (holotype of *Agaricus herbarum*); 6-7: Bandala 3037 (scale bar= 10 μm).

hyphae straight or slightly sinuous. Context with cylindric, hyaline, not gelatinized hyphae 2-10 μm diam. Hymenophoral trama subregular to subirregular, cylindric, hyaline hyphae 5-12 μm diam.; subhymenium reduced, with short-cylindric to subglobose, not gelatinized hyphae 4-8 μm diam. Clamp connections absent.

Habitat. Subgregarious to gregarious, on fallen leaves or dead herbaceous debris, in *Quercus* and mesophytic (subtropical) forests (Mexico).

Material examined. MEXICO. Baja California: Agua Viva, 18.I.1991, *Ayala 712* (BCMEX; XAL). Las Lomas, San Antonio de Las Minas, 2.II.1996, *Moreno et al. s.n.* (AH 18375; XAL). Las Chichivas, 1.II.1996, *Moreno et al. s.n.* (AH 19720). Veracruz: km 2.5 antigua carretera Xalapa-Coatepec, Jardín Botánico Fco. J. Clavijero, 27.I.1997, *Bandala 3037, 3038*; 23.I.1997, *Tapia 1608, 1609*; 4.II.1997, *Tapia 1620* (all at XAL).
European material examined for comparision. SPAIN. Guadalajara: carretera de Cifuentes a Canrredondo, 17.XII.1991, *Blanco & Heykoop s.n.* (AH 14730, as *C. herbarum*). Segovia: Balsain, 2.V.1996, *Bandala 2930-A* (XAL). Madrid: Montejo de la Sierra, 17.VI.1982, Esteve-Raventós s.n. (AH 2779).

Remarks. The habit and habitat are good field indicators to recognize this taxon. The smooth, cylindric, pale basidiospores, the whip-like shape of the cheilocystidia and the clampless hyphae are unique to *C. epibryus*. Since this taxon in the sense of Pilát (1948) embraces collections with ornamented basidiospores that correspond either with *C. luteolus* (Lambotte) Sacc. or with *C. subverrucisporus* Pilát (Singer, 1951; Senn-Irlet, 1995), the interpretation followed here is based on the concept of Senn-Irlet (1992a, 1995). This author discussed the confusions in the interpretation of Fries' taxon and provided a long synonymy. After Fries, probably the most comprehensive way to interpret *Agaricus (Crepidotus) epibryus* could be through Cooke's (1884-1886) icone (pl.515). In that plate the distinctive macrocharacters were captured and, in fact strongly resemble *Agaricus (Crepidotus) herbarum* (= *Pleurotellus graminicola* Fayod, see Horak, 1968), a name widely cited on European literature for the small *Crepidotus* species with smooth and narrowly-elongated basidiospores (Josserand, 1955; Moser, 1983; Nordstein, 1990; Ortega and Buendia, 1989; Orton, 1960; Pegler and Young, 1972; Stangl *et al.*, 1991; Strid, 1992; Watling and Gregory, 1989). Most characters of *C. epibryus* (=*C. herbarum*), including the pale basidiospore wall, are represented in different lineages of *Crepidotus*, which support its present position in this genus as Senn-Irlet (1995) noted, instead of being identified as *Pleurotellus*. This author found a resemblance between the basidiospores of *Crepidotus epibryus* with the weakly ornamented basidiospores of *C. versutus* (Peck) Sacc. In addition, we found that *C. epibryus* shares with *C. septicoides* a similar habit, and cylindric (although wider), pale pigmented basidiospores (Figs.8-14).
Crepidotus epibryus is a common encountered agaric not solely through Europe. Singer (1969) reported it under *Pleurotellus hypnophilus*, from different localities in Chile and Argentina. Lazo (1971, 1977, 1984), Horak (1979) and Garrido (1988) regarded it also in Chile, and recently, Senn-Irlet

and De Meijer (1998) reported *Crepidotus epibryus* from Brazil. It has been recorded from China and Japan too (under *Pleurotellus hypnophilus* or *Crepidotus herbarum*) (Imazeki and Hongo, 1987; Teng, 1988). In North America, the species (as *C. herbarum*) is known to occur along the Pacific coast, from Canada to California (Murrill, 1912, 1917; Hesler and Smith, 1965; Redhead, 1984), and northwest Mexico (Moreno and Ayala, 1996). Meanwhile in eastern North America, *Crepidotus epibryus* is found in Ontario, Canada through USA (Murrill, 1917; Hesler and Smith, 1965; Redhead, 1984) and central part of the Mexican Gulf region, where it appears rather common in the mesophytic forests surrounding Xalapa.

1.2. Notes on collections of *Crepidotus epibryus* from USA.

Material examined. Idaho: Nordman, Bonner Co., 5.X.1956, *Smith 54060*. Michigan: Prov. Lake, Oakland Co., 19.X.1955, *Smith 66272* (both at MICH as *C. herbarum*). New York: North Greenbush, Oct., *Peck s.n.* (NYS, Holotype of *Agaricus herbarum*). Oregon: Grant's Pass, Josephine Co., 10.XI.1956, *Smith 55365*; 12.XI.1956, *Smith 55561*; Welches, Clackamas Co., 25.X.1944, *Smith 20222*. Washington: Lake Quiniauet, Grays Harber Co., 12.X.1925, *Brown s.n.* (all at MICH, as *C. herbarum*).

Remarks. Hesler and Smith (1965) in their North American monograph of *Crepidotus* followed Pilát's concept of *C. epibryus* (i.e. with ornamented basidiospores), and consequently they distinguished it from *C. herbarum*. Redhead (1984) noted that Hesler and Smith also treated some collections of *C. herbarum* under *C. pubescens* Bres. We re-examined the above collections cited by Hesler and Smith under these two latter epithets, which were verified by Redhead as *C. herbarum*. These collections are identical with the studied Mexican and European specimens (Figs. 3-4), hence we interpret them under the concept of *C. epibryus* followed here. In fact, all the specimens are similar with the type of the North American *Agaricus herbarum* as Redhead (1984) stated. The type collection of *Agaricus herbarum*, however, was inappropriate for develop a full study. We could not observe the cheilocystidia; it has clampless hyphae and pale, cylindric, smooth basidiospores (Figs. 5 and 30), which are slightly curved on the side view as Peck (1873) noted.
Hesler and Smith (1965) stressed that their concept of the Fries' species, *Crepidotus epibryus*, was according with Pilát (1948), a concept nowadays corresponding to *C. subverrucisporus* (see Seen-Irlet, 1995). The following collections cited by Hesler and Smith as *C. epibryus* actually, are identical with the European *C. subverrucisporus*: Colorado, Ophir, San Miguel, I.VIII.1956, *Smith 51577*; 7.VIII.1956, *Smith 51950* (both at MICH under *C. epibryus*). Both collections have more or less coarsely ornamented basidiospores and lageniform cheilocystidia (Figs. 22-23), and the basidiospore ornamentation seen under SEM is verruculose (Figs. 28-29), which fit with the type specimen *Vacek s.n.* (PRM 149034).

2. *Crepidotus septicoides* (Singer) Singer, Beih. Nova Hedw. 44: 399,1973.

≡ *Marasmiellus septicoides* Singer, Mycologia 47: 773, 1955.
misint.: *Crepidotus longicystis* (Hesler & A.H. Sm.) Singer, Beih. Nova Hedw. 44: 400, 1973, non *C. fusisporus var. longicystis* Hesler & A.H.Sm., North Amer. Sp. *Crep*. p. 93, 1965.

Figs. 8-14

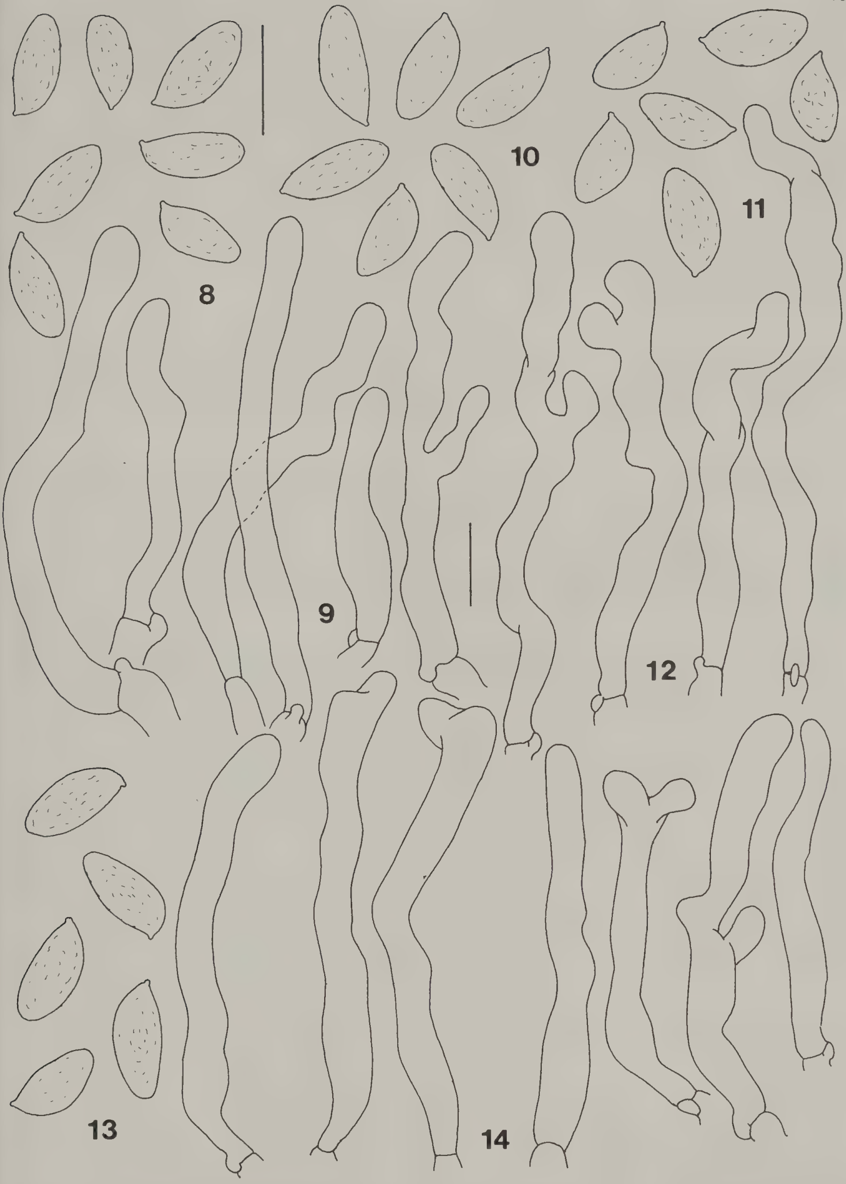
2.1. Type study of *Marasmiellus septicoides*. BRAZIL. Rio de Janeiro: Angra dos Reis, 31.IX.1952, *Singer B 427* (Holotype, F).

The type specimen consists only of small pieces of fragments of lamellae, which limits a complete study. The basidiospores are 10-12 (-12.5) x 4.5-5.5 (-6) μm [L= 11.3 ± 0.71; W= 5.1 ± 0.48; Q= 2.2 ± 0.16, n= 25], ellipsoid to subcylindric or more or less broadly-ellipsoid, somewhat subamygdaliform in profile, with a weak suprahilar depression, apically rounded, obscurely rugulose to rather smooth under immersion lens, thin-walled, pale yellowish to hyaline-yellowish, pale ochraceous in mass (Fig. 10). SEM study revealed a rather smooth wall, with some weakly rogulose areas (Fig. 33). The material has clamped hyphae, it was inadequate for the study of the cheilocystidia.

Remarks.The pigmentation exhibited by the basidiospore wall indicates the reason why Singer (1973) transferred this taxon in *Crepidotus*. In fact, basidiospores with a faintly colored wall are found in other species of the genus such as *C. epibryus*, *C. versutus* or *C. fusisporus* Hesler & A.H. Sm. (Nordstein, 1990, Senn-Irlet, 1995, Hesler and Smith, 1965). The basidiospores of *Crepidotus septicoides* are somewhat similar to those found in *C. versutus* and more or less resemble in shape those of *C. epibryus* (Figs.1-7). *Crepidotus versutus* also exhibits a similar basidiospore ornamentation when seen under SEM (Senn-Irlet, 1993). The clamp connections along with the irregularly rugulose, subcylindric basidiospores, relate *Crepidotus septicoides* with section Crepidotellae Hesler & A.H. Sm., subsect. Fibulatini Singer, according to the arrangement by Senn-Irlet (1995)

2.2. Study of Mexican collections of *Crepidotus longicystis* s. Singer:

Basidiospores 7.5-11 (-12) x 4-6 (-6.5) μm [$\overline{X}$= 9.2-10.7 x 4.7-5.6; Q_m= 1.8-2.2; L= 9.6 ± 1.02; W= 5.0 ± 0.59; Q= 1.9 ± 0.24, n= 7], ellipsoid to broadly-ellipsoid, apically rounded but often weakly attenuated (not beaked) and then somewhat subamygdaliform in profile, with a weak suprahilar depression, obscurely rugulose to almost smooth, yellowish to pale yellowish, pale ochraceous in mass, thin-walled; under SEM the wall is irregularly covered with a weak rugulose ornamentation, which is more obvious in some basidiospores than in others (Figs. 34-36). Basidia 20-30 (-35) x 7-10 μm, 4-spored, clavate, hyaline. Cheilocystidia (25-) 30-80 (-95) x 4-10 (-13) μm, subcylindric or at times somewhat broadened towards the base, then appearing more or less subcylindric-lageniform, (3-) 4-7 (-8) μm diam. at apex, flexuous, commonly



Figs. 8-14.- Basidiospores and cheilocystidia of *Crepidotus septicoides*, 8-9: Singer M 8035; 10: Singer B 427 (holotype of *Marasmiellus septicoides*); 11-12: Singer M 8057; 13-14: Singer M 8054 (scale bar= 10 μm).

with constrictions, outgrowths or bifurcated towards the apex, numerous, projected above hymenium, clamped, hyaline, thin-walled. Pileipellis a transition between a cutis and a trichoderm, with loosely interwoven, cylindric to subfilamentous, colorless, thin-walled hyphae (2-) 3-7 (-9) μm diam., not gelatinized, terminal hyphae cylindric, 4-6 μm diam., prostrated or semierect, slightly sinuous, sometimes contorted, rarely knobbed. Pileus trama with subcylindric to subventricose, hyaline, not gelatinized, 4-10 μm diam. hyphae; sometimes ventricose hyphae up to 20 (-25) μm diam. present. Hymenophoral trama subregular to subirregular, with hyaline hyphae 4-10 μm diam. Clamp connections present.

Material examined. MEXICO. Veracruz: 7 km al S de Montepio, Estación Biológica de Los Tuxtlas, 19.VI 1969, *Singer M 8035*, *M 8044* (both as *C. longicystis var. palmicola*, ined. name, F), *M 8054* (as *C. septicoides*, F); 20.VI.1969, *Singer M 8057,M 8081, M 8089*; 21.VI.1969, *Singer M 8109* (all at F as *C. longicystis*).

Remarks. The basidiospore shape could be presumably the reason why Singer (1973) placed above Mexican collections under the taxon named by Hesler and Smith (1965) *Crepidotus fusisporus var. longicystis*. We found that the microscopical characters (basidiospores, cheilocystidia) of the type collection of *var. longicystis* (*Smith 32464*, at MICH) are different from those of the Mexican materials, and therefore they can not be considered conspecific. However, the Mexican material identified by Singer (1973) as *Crepidotus longicystis* is related to *C. septicoides*. Actually, Singer indicated (p. 403) the close resemblance between the Mexican specimens and this latter taxon, and even one of the above collections (*Singer M 8054*) is at F determined by Singer as *C. septicoides*, but treated under*C. longicystis* in his work of 1973. The discriminating characters used by this author to segregate them were the pileus size (2-8 mm diam.), its sulcate margin and the differences in basidiospore dimension. The Mexican collections, however, are intermediate with respect to the pileus size, the margin variation and the presence or absence of an incision in the rear portion, at least in the herbarium material. The type collection of *Marasmiellus septicoides* is in very poor conditions to make a critical comparison. Nevertheless, the basidiospores are similar to those of Mexican specimens (Fig. 10) and the SEM did not reveal any difference. The mean values of the basidiospore size of all examined collections did not show clear differences among the samples. Thus, the spore size alone (Fig. 15) does not demonstrate the segregation of another taxon. The variation of the basidiospore shape in individuals of the same collection is rather marked, and It may be related with the basidiomes development. Collections *Singer 8057* and *8044*, present a basidiospore variation from more or less small and subamygdaliform to long and subellipsoid. Singer (1973) emphasized this fact in his observations. After a critical analysis of the information on the macroscopic features provided by Singer (1955, 1973), and

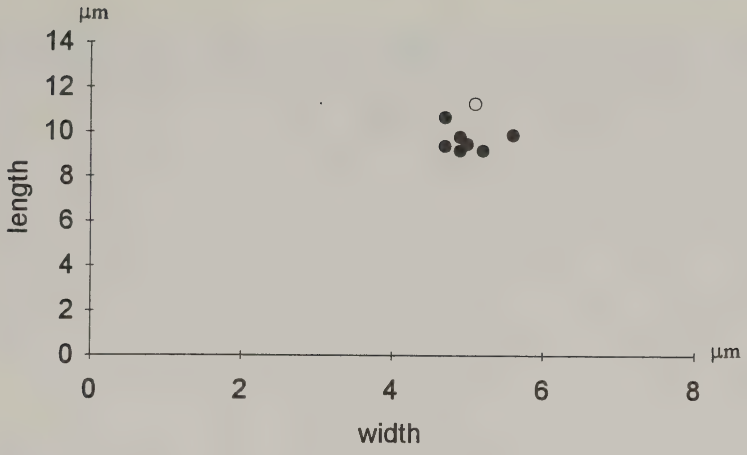


Fig.15. Scatter plot of basidiospore size (means) of collections of *Crepidotus septicoides* (○=holotype of *Marasmiellus septicoides*).

on the basis of our macro and microscopical observations on the specimens examined, we conclude that all collections represent the variation of the same taxon.

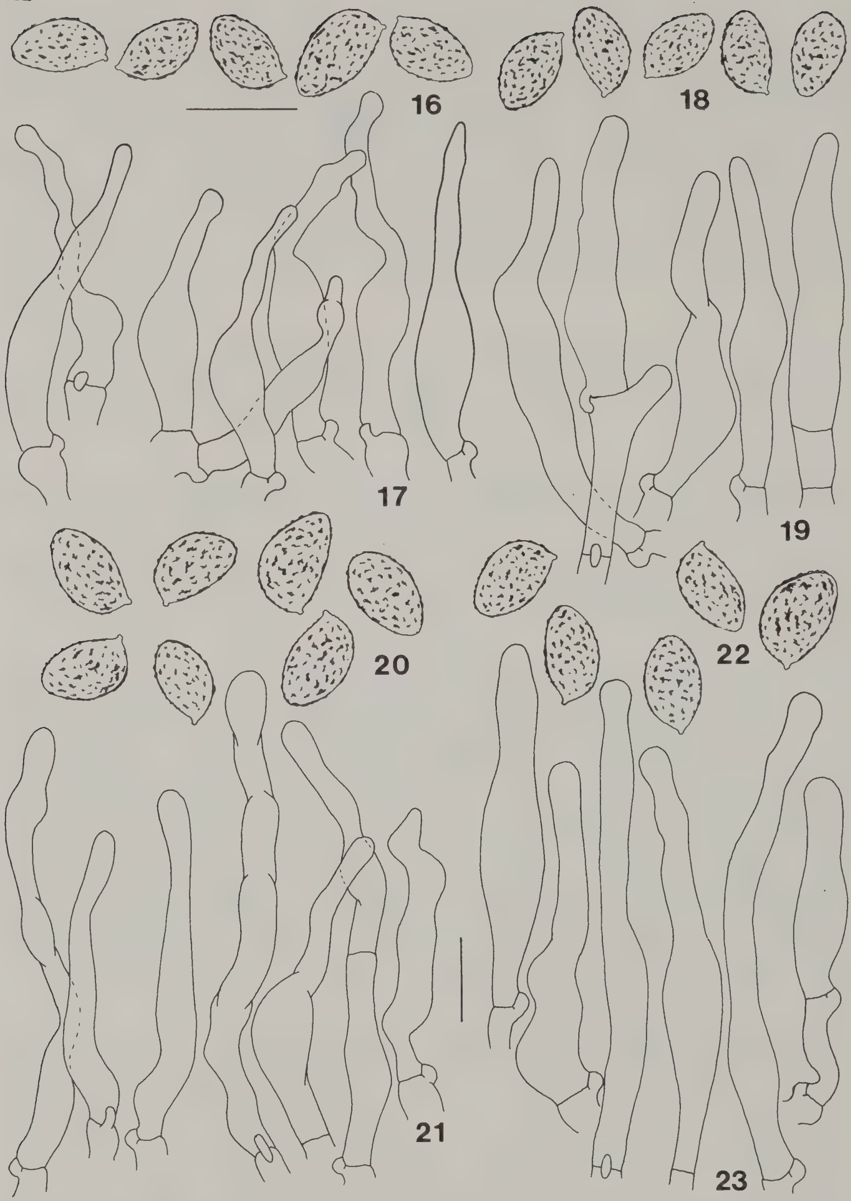
Crepidotus septicoides is recognized by the following set of characters: white basidiomata, long, faintly rugulose basidiospores, the shape and size of cheilocystidia, and clamped hyphae. If fresh data on the basidiomata are not available, a careful microscopic study must be made in order to distinguish it from *Crepidotus luteolus* (Lambotte) Sacc. Both species share clamped hyphae and have basidiospores and cheilocystidia with similar size and shape. However, specimens of *C. luteolus*, which are pigmented (yellow) (Moser and Jülich, 1987; Senn-Irlet, 1995), have basidiospores that tend to be more amygdaliform-elongate and under immersion lens the basidiospore wall is evidently ornamented and more pigmented. In addition, SEM analysis of the basidiospore ornamentation of *C. luteolus* reveals a distinctive rugulose-verruculose pattern (Senn-Irlet, 1995).

3. ***Crepidotus albatus*** **Hesler & A.H. Sm.**, North Amer. Sp. *Crep*. p. 83, 1965.

Figs. 16-17

Type study. USA: Michigan, 14.VIII.1963, *Smith 67203* (Holotype, MICH).

Basidiospores 7.5-10 x (4.5-) 5-6.5 *µ*m [L= 8.8 ± 0.70; W= 5.7 ± 0.40; Q= 1.5 ± 0.09, n=25], ellipsoid or broadly-ellipsoid to subamygdaliform, slightly attenuated toward the apex, strongly-verruculose to verrucose, with somewhat evident, irregular warts, wall yellowish to pale yellowish, ornamentation brownish-orange, in mass yellowish-brown, more or less thick-walled (up to 0.5 *µ*m); under SEM irregularly verruculose, i.e. with more or less isolated or more commonly interconnected plane warts, often forming short patches (Figs. 24-



Figs. 16-23.- Basidiospores and cheilocystidia of *Crepidotus subverrucisporus*, 16-17: Smith 67203 (holotype of *C. albatus*); 18-19: Vacek s.n. (holotype of *C. subverrucisporus*); 20-21: Favre 2440/2; 22-23: Smith 51950 (scale bar= 10 μm).

25). Basidia 28-35 x 7-8 μm, 4-spored, clavate, hyaline. Pleurocystidia absent; some steril basidiole-like elements rarely present on the sides of the lamellae. Cheilocystidia 27-50 x 5-9 μm, lageniform to more or less narrowly-lageniform, rarely fusoid, with a slender, often flexuous neck, apex commonly subcapitate or at times slightly acute, 2-4 μm diam., numerous, projected above hymenium, forming a more or less dense, steril layer on lamellae edge, hyaline, thin-walled, clamped. Pileipellis a transition between a cutis and a trichoderm, with cylindric, hyaline, thin-walled hyphae 3-8 μm diam., more compactly arranged toward the pileus front, with scattered, somewhat flexuous, terminal hyphae. Pileus trama more or less loosely interwoven, with hyphae 4-10 μm diam., cylindric to subventricose, hyaline, some bifurcate. Hymenophoral trama subregular to sub-irregular, with cylindric or subventricose, sometimes bifurcate, hyaline hyphae 4-10 μm diam. Clamp connections present.

Material examined for comparison. *Crepidotus subverrucisporus*, CZECHOSLOVAKIA. Bohemia, Chrustenica, 20.VII.1946, *Vacek s.n.* (Holotype, PRM 149034). SWITZERLAND. Chaposch-Flurins, 6.IX.1945, *Favre 2440/2* (G 13810).

Remarks. The white color of the basidiomes reported by Hesler and Smith (1965), as well as the striking narrowly-lageniform cheilocystidia and the strongly-verruculose (subamygdaliform) basidiospores are a set of characters that fit well with the European *C. subverrucisporus* Pilát (1949). Therefore, *C. albatus* must be regarded as a synonym. The specimens from USA coincide with the European collections examined, including the basidiospore ornamentation when observed under SEM (Figs. 24-29). The size and shape of the cheilocystidia (a lageniform pattern) are consistent through the collections with some minor variation of the apical portion. This is interpreted here as part of the taxon variation; for example, in Vacek's collection the neck is somewhat straight or slightly sinuous, whereas in the other two collections, it is slightly sinuous or with weak constrictions tending to be subcapitated (Figs. 16-23). Senn-Irlet (1993, 1995) mentioned the variability of the cheilocystidia in European collections of *Crepidotus subverrucisporus*, and she found septated and branched forms. The so-called pleurocystidia on the sides of lamellae mentioned by Hesler and Smith (1965) in the type of *C. albatus*, were rarely observed and, in fact, resemble in shape to basidia (abnormal?) or basidioles. We do not interpret these structures as true pleurocystidia, and consequently, without any taxonomic value to distinguish the specimens as an independent taxon.

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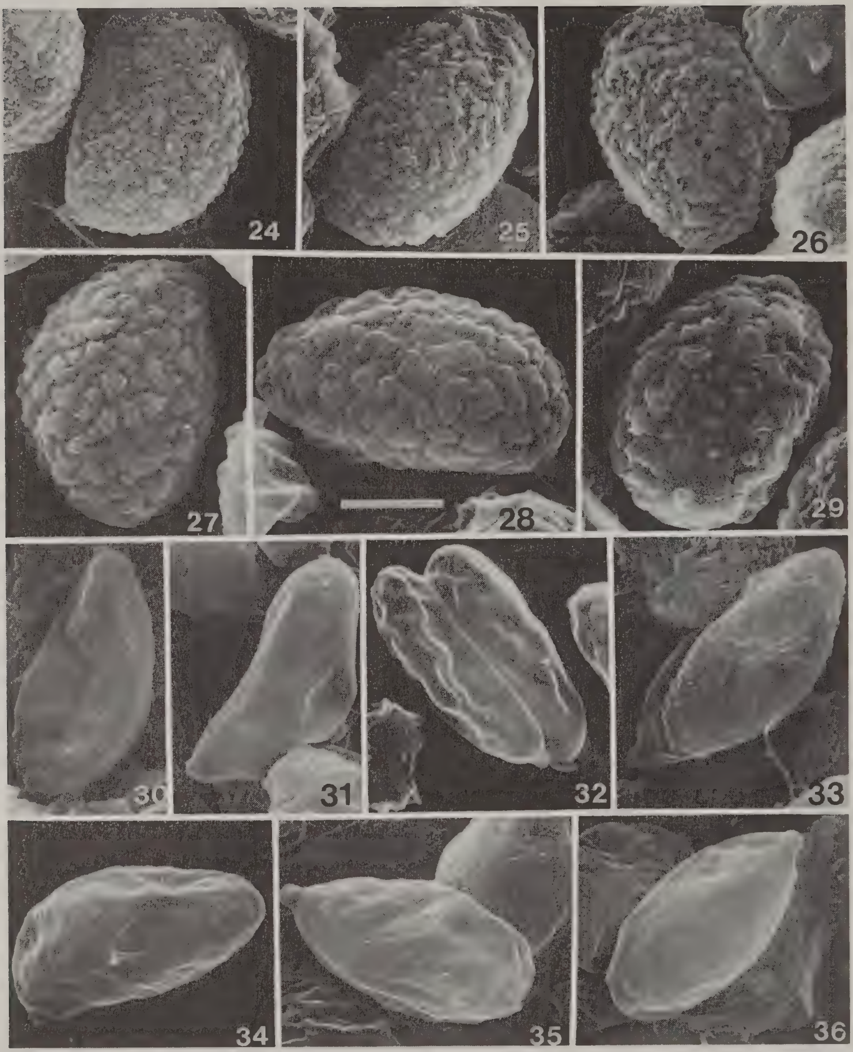

Figs. 24-36.- Photomicrographs of *Crepidotus* basidiospores. 24-29: *C. subverrucisporus*, 24-25: Smith 67203 (holotype of *C. albatus*); 26: Vacek s.n. (holotype of *C. subverrucisporus*); 27: Favre 2440/2; 28: Smith 51577; 29: Smith 51950. 30-32: *C. epibryus*, 30: Peck s.n. (holotype of *Agaricus herbarum*); 31: Bandala 2930-A; 32: Bandala 3038. 33-36: *C. septicoides*, 33: Singer B 427 (holotype of *Marasmiellus septicoides*); 34: Singer M 8109; 35: Singer M 8035; 36: Singer M 8089 (scale bar= 3.4 μm, except 28,30-31= 2.8 μm, and 33-36= 4 μm).

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TWO NORTH AMERICAN INONOTUS (HYMENOCHAETACEAE, APHYLLOPHORALES) FOUND IN ARGENTINA

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Abstract

Inonotus quercustris and *I. texanus* are recorded and described for the first time outside their known distributional range in the USA. They were found in the subxerophytic to xerophytic Chaco phytogeographical Province in Central W and NW Argentina, growing on *Lithraea ternifolia* (Anacardiaceae) and *Acacia caven* (Fabaceae), and *Acacia* sp., *Prosopis* sp. (Fabaceae) and *Schinopsis quebracho-colorado* (Anacardiaceae), respectively.

Key words: polypores, Chaco, *Inonotus*

Introduction

The polypores found in the Chaco phytogeographical Province of Argentina (Cabrera 1971, Cabrera & Willink 1980) have been treated by numerous authors (Bazzalo & Wright 1984, Iaconis & Wright 1953, Popoff & Wright 1998, Rajchenberg 1984, Spegazzini 1926, Wright & Blumenfeld 1984, Wright & Deschamps 1975 and 1976, Wright *et al.* 1973, Wright *et al.* unpublished) but most of them refer to the relatively humid “Distrito Oriental” whereas few references record the species found in the dryer “Distrito Occidental” and “Distrito Serrano”. During a survey of Aphyllophorales found in the aforementioned districts (Urcelay 1998) two poroid Hymenochaetaceae were recorded that pertain in the genus *Inonotus* P. Karst. and were previously known only from the USA. The aim of this work is to give full descriptions of these taxa.

The species

Inonotus quercustris M. Blackwell & Gilb.,
Mycotaxon 23: 286, 1985. Figs. 1-6

Basidiocarp annual, sessile, applanate to ungulate, solitary or with several imbricate pilei, to 21 x 32 x 11 cm, light in weight. Pilear surface glabrous, azonate, the different areas varying from yellowish, dirty orange to chestnut, blackening with age here and there. Margin blunt to angular. Hymenial surface first yellowish, turning olivaceous to chestnut olivaceous with age, pores (1-)2(-3)/mm, angular, pore mouths lacerated to dentate. Context fibrous to somewhat spongy, to 8 cm thick, zonated. Tubes golden brown, to 3 cm long.

Hyphal system monomitic. Generative hyphae simple-septate, occasionally branched. Hyphae in the upper context 4-10 µm in diam., hyaline, light yellowish to chestnut, thin to thick walled; hyphae in the median portion of the context 3-7 µm in diam., mostly golden chestnut, thin to thick walled, and then covered with crystals. Tramal hyphae 3-6.5 µm in diam., thin to thick walled, yellowish to light chestnut.

Setal hyphae present in the dissepiments, parallel to the tubes, to 310 µm long, 8-13 µm in diam. at the widest point, with very thick walls, dark chestnut, subulate, frequent but rare in some sections.

Setae absent.

Basidia clavate, 16-21 x 7-10 µm, with 4 sterigmata.

Basidiospores ellipsoid, 8-10 x 6-7 µm, with thickened, light golden, IKI- walls.

Associated wood-rot white.

Substrate: On living *Lithraea ternifolia* (Anacardiaceae) and *Acacia caven* (Fabaceae).

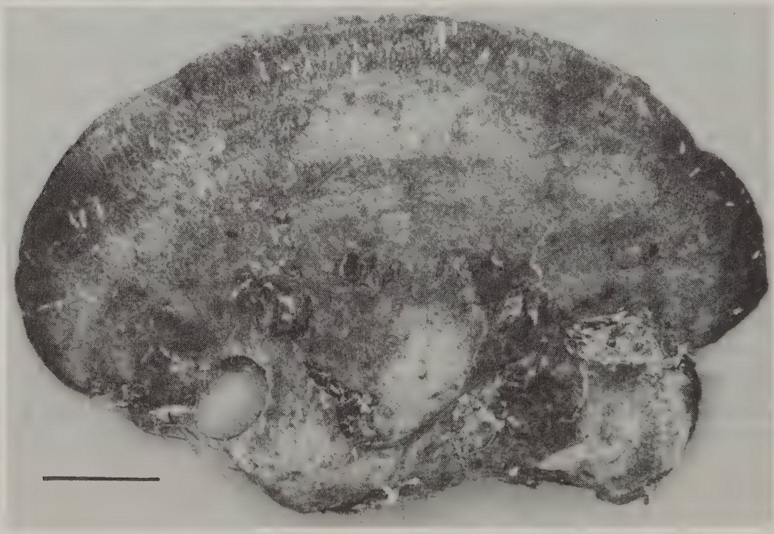
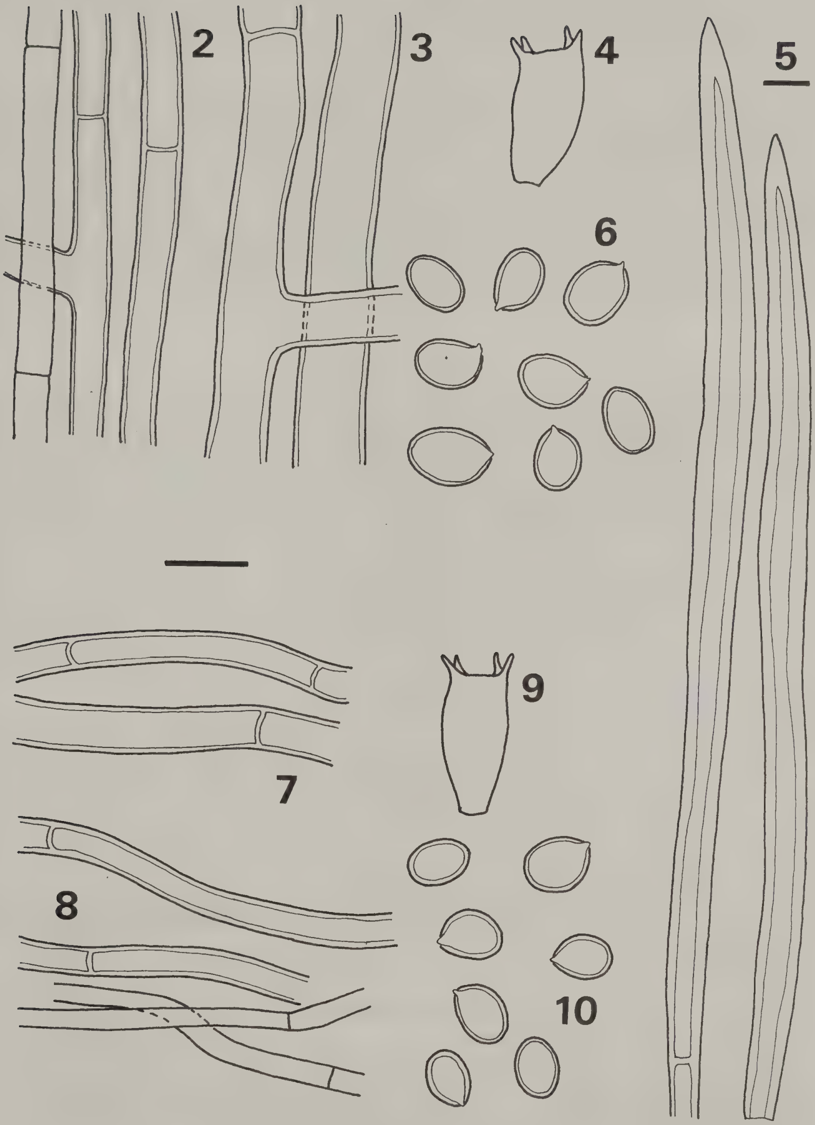


Fig. 1. *Inonotus quercustris*, basidiocarp (Urcelay n° 63, CORD). Bar= 5 cm



Figs. 2-6, *Inonotus quercustris*, microscopical features: 2, tramal hyphae. 3, contextual hyphae. 4, basidium. 5, setal hyphae. 6, basidiospores. Figs. 7-10. *Inonotus texanus*, microscopical features: 7. contextual hyphae. 8, tramal hyphae. 9, basidium. 10, basidiospores. Bars= 10 µm

Material studied: ARGENTINA, La Rioja, Cordón del Velazco, oriental slope, 1700 m asl, leg. C. Urcelay n° 63, 30.Jun.97 (CORD). Córdoba, road from Los Patayes to La Candelaria, Dpto. Cruz del eje, leg. C. Urcelay n° 64, Oct.98 (CORD). San Luis, Merlo, leg. C. Urcelay n° 75, 78 and 79, Nov.98 (CORD).

Remarks: Recorded from Louisiana (Blackwell & Gilbertson 1985) and from Texas (Metzler & Metzler 1992) in the USA, where it grows on living water oak (*Quercus nigra*); its discovery in xerophytic areas of Central W Argentina is quite surprising. Our materials fit the descriptions very well (Blackwell & Gilbertson 1985, Gilbertson & Ryvarden 1986). Representative specimens from Baton Rouge Herbarium (LSU), Tucson Herbarium (ARIZ) and the holotype at BPI were not available for study.

Inonotus texanus Murrill,
Bull. Torrey Bot. Club 31: 597, 1904. Figs. 7-10

Basidiocarp annual, solitary, sessile, ungulate, 4 x 5 x 4 cm, light in weight, attached to the substrate by a back, median, longitudinal ribbon-like structure. Pilear surface glabrous, indurating, cracking radially and concentrically, light to dark chestnut to almost black. Margin blunt. Hymenial surface straight to concave, light to yellowish chestnut, darkening with age; pores round to angular, 1-3/mm; dissepiments thin, pore mouths lacerated to slightly dentate. Context fibrous, relatively thin, to 5 mm thick, chestnut to golden brown; with a corky, granular core present near the attachment point, presenting white dots here and there, but poorly developed. Tubes to 3 cm long, fragile and brittle, concolorous with the context.

Hyphal system monomitic. Generative hyphae simple-septate; in the context 3-6.5 µm in diam., with thin to thickened, light golden brown walls, branched or not. In the dissepiments the thin-walled hyphae are narrower, 1.5-3.5 µm in diam. and the thick walled hyphae 3-5 µm in diam.

Setae and **setal hyphae** absent.

Basidia clavate, 16-20 x 6-8 µm, 4-sterigmate.

Basidiospores ovoid to ellipsoid, 7-8 x 5.5-6.5 µm, with thickened walls, IKI-, golden-brown.

Associated wood-rot white.

Substrate: On standing, young and mature *Acacia* sp., *Prosopis* sp. and *Schinopsis quebracho-colorado*.

Material studied: ARGENTINA, Córdoba, Dpto. Pocho, Reserva Provincial Chancaní, leg. C. Urcelay n° 04, 05 and 08, Nov.96 (CORD). Santiago del Estero, Dpto. Copo, Reserva El Copo, leg. J. Protomastro, Mar.86 (BAFC 30686).

Remarks: In the USA this species is also characteristic of xerophytic areas, being distributed in the SW States, where it grows exclusively on *Prosopis* and *Acacia*. The Argentinian specimens differ in lacking a well developed granular core

[Gilbertson & Ryvarden 1986, but *cfr*. Overholts (1953), who does not mention this feature in his description of the species], but is otherways similar.

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TAXONOMIC STUDIES OF ALTERNARIA FROM CHINA VI. NEW SPECIES AND NEW RECORDS TO CHINA ON CRUCIFERAE, CUCURBITACEAE, AND EUPHORBIACEAE*

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ABSTRACT 4 new species of *Alternaria* and 4 new records to China in the same genus are reported. They are: *Alternaria napiformis* (new rec.) on Cruciferae; *A. luffae* sp. nov. and *A. peponicola* (new rec.) on Cucurbitaceae; *A. kansuiae* sp. nov., *A. biproliformis* sp. nov., *A. manihotis* sp. nov., *A. euphorbiae* (new rec.) and *A. compacta* (new rec.) on Euphorbiaceae. Latin diagnoses and illustrations of the new species are provided. The type specimens of the new species are deposited in Herbarium of Shandong Agricultural University: Plant Pathology (HSAUP).

KEY WORDS *Alternaria* *A. luffae* *A. kansuiae* *A. biproliformis* *A. manihotis*

Taxon on Cruciferae

Alternaria napiformis Purkayastha et Mallik, Nova Hedwigia 27 (3-4) : 783, 1976.

On leaf spots of *Isatis tinctoria* L., Xian, Shaanxi Province, 24 IX 1993, coll. Zhang JZ and Wang J. (no. ZW 93-142), HSAUP 950093.

This fungus is a new record to China.

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Taxa on Cucurbitaceae

Alternaria luffae T. Y. Zhang, sp. nov. Fig.1

Maculae suborbicularis vel irregularis, infuscatae. Conidiophora solitaria vel fasciculata, erecta, recta vel geniculata, infuscata, septata, 30-66.5×5-5.5 μ m. Conidia solitaria, vel catenuata, infuscata vel atro-brunnea, ovoidea vel ellipsoidea, 3-6 transverse septata, 0-4 longitudinaliter vel oblique septata, 27.5-49×11-15.5 μ m. Rostra non vel brevia.

Hab. in foliis vivis *Luffae cylindricae* (L.) Roem., Guilin, Guangxi Provincia, 30 Ⅸ 1982, coll. Li JY & Zhang DF, (no. 51341-1), HSAUP 950972, Holotypus.

On leaf spots of *Luffa cylindrica* (L.) Roem., leaf spots suborbicular or irregular, light brown. Conidiophores solitary or fasciculate, erect, straight or geniculate, septate, light brown, 30-66.5×5-5.5 μ m; Conidia solitary or in short chains, ovoid or ellipsoid, light brown to mid brown, lighter towards the apex, with 3-6 transverse and 0-4 longitudinal or oblique septa, spore bodies 27.5-49×11-15.5 μ m; Rostra: beakless or occasionally with short rostra.

This fungus can be readily separeted from 8 described species of *Alternaria* on plants of Cucurbitaceae (Letendre et Roumeguere, 1886; Peglion, 1893; Rostrup, 1893; Saccardo, 1905; Elliot, 1917; Yatel, 1938; Jorstad, 1945; Simmons, 1982) by the morphology of its ovoid, ellipsoid, usually non-beaked conidia.

Alternaria peponicola (G.L.Rabenhorst) E.G.Simmons, Mycotaxon 14 (1): 45-47, 1982.

Macrosporium peponicola Rabenh., Sitzungsber. Naturwiss. Ges. Isis Dresden: 101, Tab. Ⅵ, 1867.

Sporidesmium mucosum Sacc. var. *Pluriseptatum* Karsten & Hariot, J. de Botanique 4: 363, 1890, fide Simmons, 1982.

Alternaria pluriseptata (karst.&Har.) Jorstad (1945), Meld. Statens Plantepat. Inst., Oslo, 1:C95 (as "*A*. cf *Pluriseptata* (Karst. & Har. ex Peck) n. comb. "), fide Simmons, 1982.

On *Cucumis melo* L. var. *beilangua* CV, Zhangye, Gansu Province, 18. Ⅻ, 1991 （Communication） coll. Wei YL. (no. 103101), HSAUP 950973 ; *Bolbostemma paniculatum* (Maxim.) Franguet., Xian, Shaanxi Province, 24 Ⅸ 1993, coll. Zhang JZ and Wang J, (no. ZW 93-107), HSAUP 950076; *Cucurbita moschata* (Duch.) Poiret, Taian, Shandong Province, 24 Ⅸ 1995, coll. Zhang TY et al, (no. ZCG 95-015), HSAUP 950414; *Cucumis melo* L., Taian, Shandong Province, 24 Ⅸ 1995, coll. Zhang TY et al, (no. ZCG 95-077), HSAUP 950477.

This fungus is a new record to China.

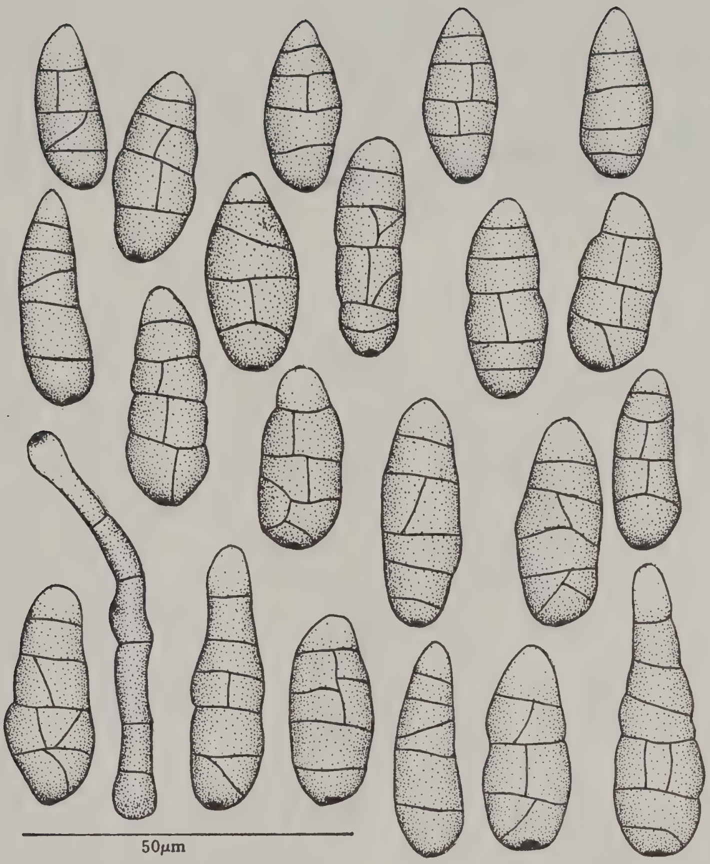

Fig.1. Conidia and conidiophores of *Alternaria luffae* T. Y. Zhang

Taxa on Euphorbiaceae

Alternaria kansuiae T. Y. Zhang et J. Z. Zhang, sp. nov. Fig.2

Maculae suborbiculares, vel irregulares, flavo-brunneae, 5 mm diam.. Caespituli epigeni. Conidiophora solitaria vel fasciculata, infuscata, erecta, recta vel geniculata, aliquando ramosa, septata, 32-65 × 5-7 μ m. Conidia solitaria, aliquando 2-3 catenuata, infuscata, obpyriformia vel obclavata, 3-9 transverse septata, 3-7 longitudinaliter septata, 0-3 oblique septata, 30-55 × 15.5-25 μ m. Rostra cylindrica, pallide brunnea, septata, 13-41 × 2.5-4.5 μ m.

Hab. in foliis vivis *Euphorbiae kansui* Liou., Xian, Shaanxi Provincia, 24 IX 1993, Leg. Zhang JZ & Wang J., (no. ZW93-147), HSAUP 950096, Holotypus.

Leaf spots subcircular or irregular, yellowish brown, ca. 5mm in diam. Fruiting epigenous. Conidiophores solitary or fasciculate, erect, straight or geniculate, light brown, septate, occasionally branched, with one to several scars, 32-65×5-7 μm; Conidia solitary, rarely in short chains of 2-3 spores, light brown, obpyriform or obclavate, with 3-9 transverse septa, 3-7 longitudinal and 0-3 oblique septa, spore bodies 30-55×15.5-25 μm; Rostra cylindrical, sparsely septated, very light brown or hyaline, 13-41×2.5-4.5 μm.

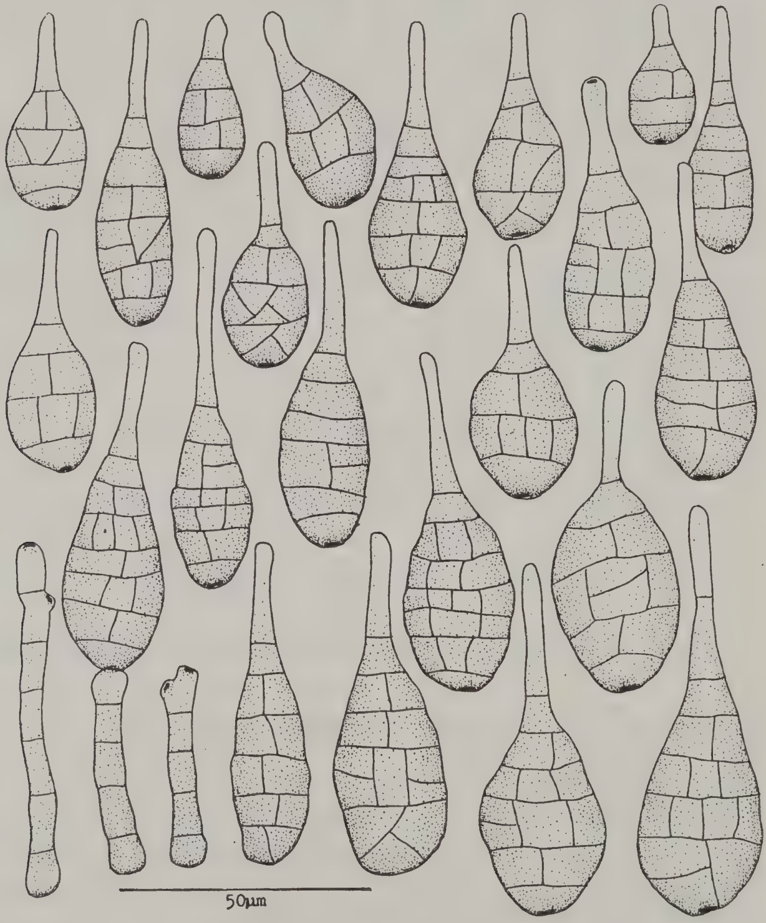

Fig.2. conidia and conidiophores of *Alternaria kansuiae* T. Y. Zhang et J. Z. Zhang

The character of distinctive obpyriform conidia of *A. kansuiae* differentiates it from all described species of *Alternaria* on Euphorbiaceae.

Alternaria biproliformis T. Y. Zhang, sp. nov. Fig.3

Etym: Latin, biproliformis = to proliferate conidia in two forms.

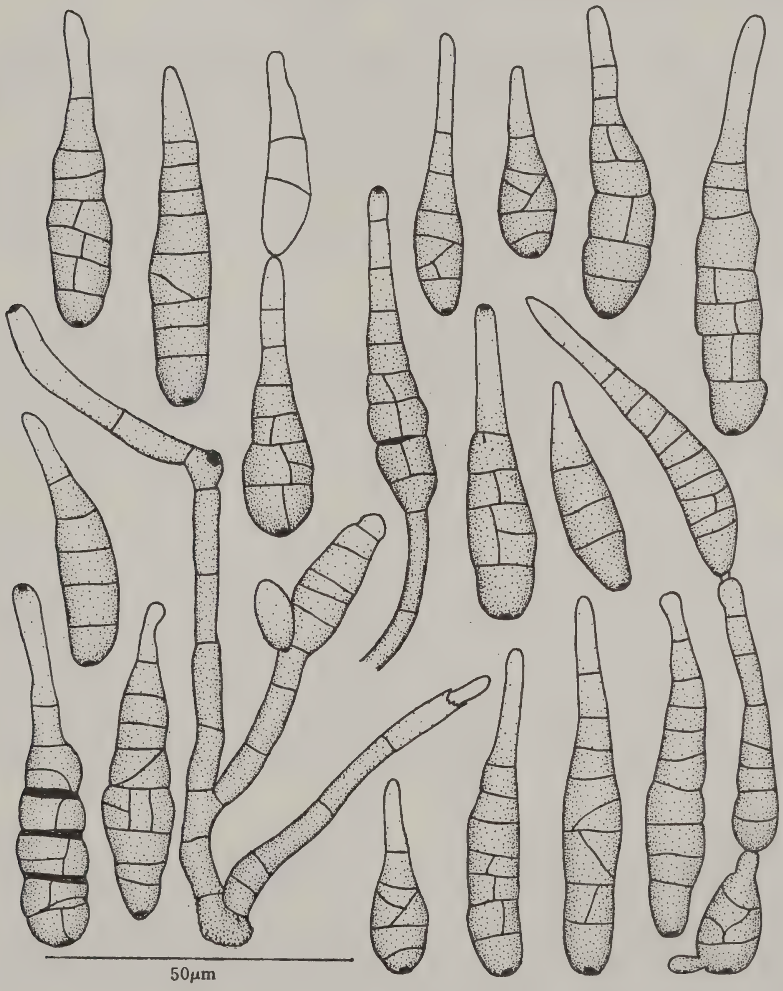

Fig.3. Conidia and conidiophores of *Alternaria biproliformis* T. Y. Zhang.

Maculae irregulares. Caesptuli epigeni. Conidiophora solitaria vel fasciculata, infuscata, erecta, recta vel geniculata, ramosa vel non ramosa, septata, 49-112×4-5 μm. Conidia solitaria vel breviter catenuata, pallide olivaceo brunnea vel brunnea, obclavata vel longe ellisoidea, 4-9 transverse septata, 0-4 longitudinaliter vel oblique septata, 20-45×8.5-11.5 μm. Rostra hyalina vel brunneola, septata vel non septata, 5-27.5×2-4 μm.

Hab. in foliis vivis *Euphorbiae* sp., Linqing, Shandong Provincia, 11 IX 1996, Leg. Zhang TY, (no. ZTY96-065), HSAUP 96065, Holotypus.

Leaf spots irregular. Fruiting epigenous. Conidiophores solitary or fasciculate, branched or unbranched, light brown, septate, erect, straight or geniculate, 49-112×4-5 μm, holoblastic conidial proliferation can often be seen besides the common enteroblastic (tretic) one; Conidia solitary or in short chains, olivaceous brown to brown, obclavate or long ellipsoid, with 4-9 transverse and 0-4 longitudinal or oblique septa, spore bodies 20-45×8.5-11.5 μm; Rostra hyaline or very light brown, septate or aseptate, 5-27.5×2-4 μm.

The most colsely resembled species of *Alternaria* on Euphorbiaceae in conidial morphology and shape are *A.crotonis* Kamal, Singh & Kumar (1979) and *A. heveae* Simmons (1994). This new fungus can be readily differentiated from the two species by its two (enteroblastic and holoblastic) parallelly running conidial proliferation patterns.

Alternaria manihotis T. Y. Zhang, sp. nov. Fig 4

Maculae irregulares, infuscatae. Conidiophora solitaria, infuscata, erecta, recta vel geniculata, interdum ramosa, septata, 47.5-103.5×3-4.5 μm. Conidia solitaria vel interdum breviter catenuata, infuscata, obclavata vel longe ellipsoidea, 4-8 transverse septata, 1-4 longitudinaliter vel oblique septata, (22.5-)33.5-47×9-11.5(-17) μm. Rostra vel pseudorostra cylindrica, hyalina vel pallidea, septata, 17-70×2-3.5 μm.

Hab. in foliis vivis *Manihotis esculentae* Crantz, Xiamen, Fujian Provincia, 3 XI 1995, Leg. Zhang TY and Gao MX, (no. ZG95-170), HSAUP 950830, Holotypus.

Leaf spots irregular, very light brown. Fruiting epigenous. Conidiophores solitary, light brown, erect, straight or geniculate, septate , rarely branched, 47.5-103.5×3-4.5 μm; Conidia solitary, occasionally in short chains, light brown, obclavate or long ellipsoid, with 4-8 transverse and 1-4 longitudinal or oblique septa, spore bodies (22.5-) 33.5-47×9-11.5 (-17) μm; Rostra and pseudorostra cylindrical, septate, light brown or hyaline, 17-70×2-3.5 μm.

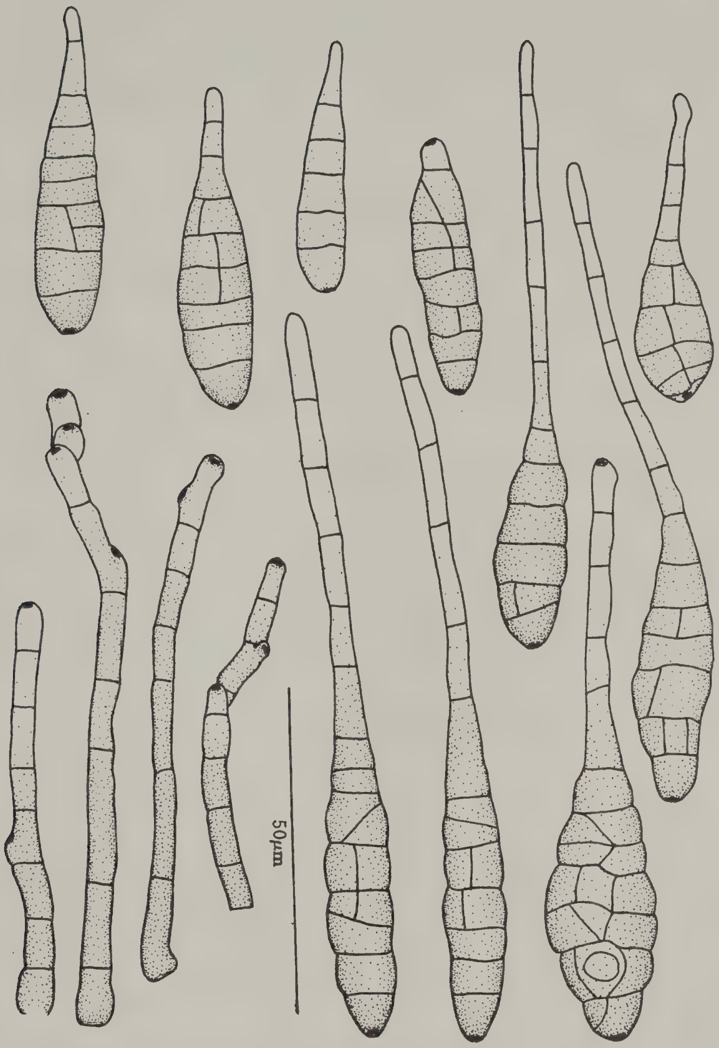

Fig.4. Conidia and conidiophores of *Alternaria manihotis* T. Y. Zhang .

This fungus is somewhat resemble to the common species *A. alternata* (Fr.) Keissler and *A. tenuissima* (Fr.) Wiltshire, morphologically. The Characters of tenuous conidiophores and slender, mostly cylindrically beaked, short-chain forming conidia differentiate it form the above two mentioned species.

Ahernaria compacta (Cooke) McClellan, Phytopath. **34**: 229, 1944.

Macrosporium compacta Cooke, J., Linn. Soc. London, **17**:141, 1880.

On dead pedicels, leafstalks and small branches of *Ricinus communis* L., Changqing, Shandong Province, 2 Ⅸ 1996, coll. Zhang TY (no. ZTY 96060), HSAUP 960060.

It is a new record to China.

Alternaria euphorbiae (Bathol.) Aragaki & Uchida, Plant Diseases, **70**: 75, 1986.

Macrosporium euphorbiae Batholomew, E., in Batholomew, E., Fungi Columbiani no.2633 (exsiccata), 1908.

On leaf spots of *Euphorbia heterophylla* L., Nanning, Guangxi Province, 25 Ⅹ 1991, Coll. Zhang TY, HMUABO 100361a.

It is a new record to China.

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The authors are grateful to Professor Kong HZ and Professor Bai JK for reviewing the manuscript. Thanks are due to Prof. Guo YL for preparing the Latin diagnoses and to Prof. Wei YL, Miss Wang J, Miss Chen Y, and Miss Gao MX for collecting some specimens. We appretiate Mr. Meng FC for inking the line drawings.

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中国链格孢 (ALTERNARIA) 分类研究 VI. 生于大戟科、葫芦科和十字花科植物上的新种和中国新记录种*

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摘要：本文报道 4 个链格孢新种和 4 个中国新记录种。它们是：生于十字花科(Cruciferae)植物上的芜青链格孢(*Alternaria napiformis*, 新记录)、生于葫芦科(Cucurbitaceae)植物上的丝瓜链格孢(*A. luffae*，新种)和西葫芦生链格孢(*A. peponicola*, 新记录)、生于大戟科(Euphorbiaceae)植物上的甘遂链格孢(*A. kansuiae*, 新种)、双式链格孢(*A. biproliformis*, 新种)、木薯链格孢(*A. manihotis*, 新种)、大戟链格孢(*A. euphorbiae*, 新记录)和密实链格孢(*A. compacta*, 新记录)。新种均有拉丁语描述和绘图。新种模式标本保藏在山东农业大学植物病理标本室(HSAUP)。

关键词：链格孢属， 丝瓜链格孢， 甘遂链格孢， 双式链格孢， 木薯链格孢

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* 国家自然科学基金资助课题。

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TAXONOMIC STUDIES OF ALTERNARIA FROM CHINA VII. NEW TAXA ON FAGACEAE, MAGNOLIACEAE, MELIACEAE,AND MORACEAE*

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ABSTRACT 3 new species and 2 new forma specialis of *Alternaria* are reported in this paper. They are: *Alternaria querci* T. Y. Zhang, J. Z. Zhang et W. Q. Chen on Fagaceae; *A. liriodendri* T. Y. Zhang et J. Z. Zhang and *A. tenuissima* f. sp. *magnoliicola* on Magnoliaceae; *A. tenuissima* f. sp. *toonae* on Meliaceae and *A. broussonetiae* T. Y. Zhang, W. Q. Chen et M. X. Gao on Moraceae. Latin diagnoses and illustrations of the new species are provided . The type specimens of the new species are diposited in the Herbarium of Shandong Agricultural University: Plant Pathology (HSAUP).

KEY WORDS *Alternaria querci, A. liriodendri, A. broussonetiae A. tenuissima* f. sp. *magnoliicola, A. tenuissima* f. sp. *toonae,*

Alternaria querci T. Y. Zhang, J. Z. Zhang et W. Q. Chen, sp. nov. Fig1

Maculae irregulares, pallide brunneae. Caespituli epigeni. Conidiophora solitaria vel fasciculata, atro-brunnea, erecta, recta vel geniculata, septata, 47.5-65 × 3.5-6 μ m. Conidia solitaria vel breviter catenuata, brunnea vel atro-brunnea, obpyriformia, ellipsoidea vel ovoidea, 3-6 transverse septata, 2-4 longitudinaliter vel oblique septata, 19.5-47 × 12-25 μ m. Rostra cylindrica vel subulata, ad apicem leviter sufflata, 8-24 × 3.5-5 μ m.

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Hab. in foliis vivis *Querci liaotungensis* Koiz. (Fagaceae), Yangling,Shaanxi Provincia, 29 Ⅸ 1993, leg. Zhang JZ & Wang J (no. ZW93-213), HSAUP 950123, Holotypus.

Leaf spots irregular, pale brown. Fruiting mainly epigenous. Conidiophores solitary or fasciculate, erect, straight or geniculate, dark

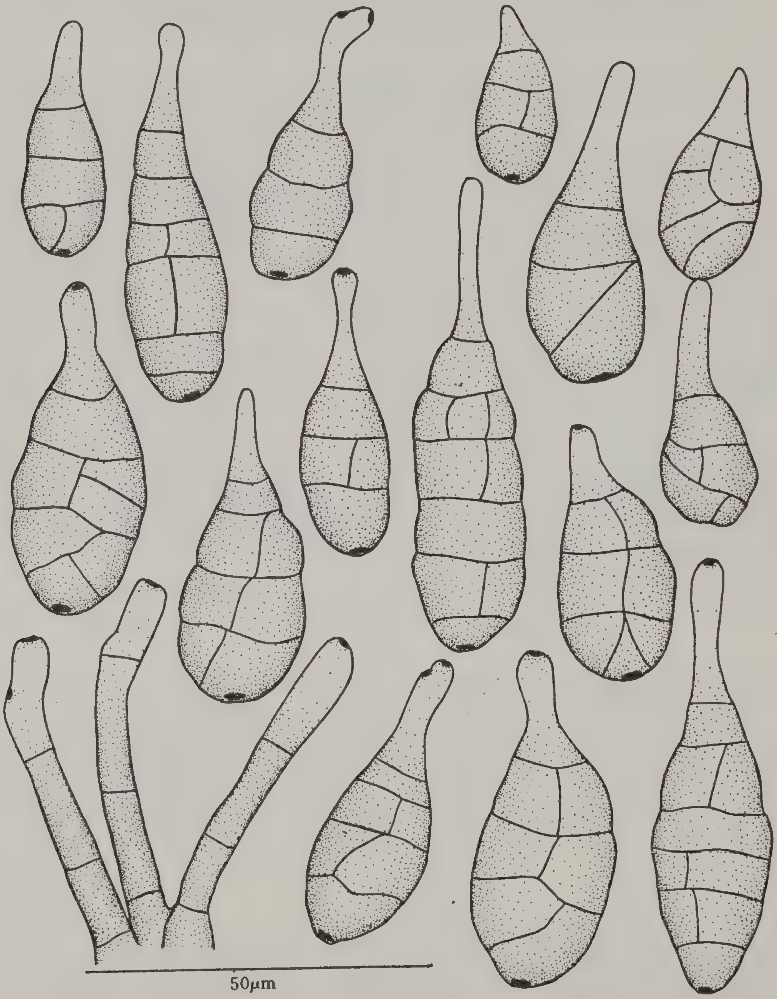

Fig.1. Conidia and conidiophores of *Alternaria querci* T. Y. Zhang, J. Z. Zhang et W. Q. Chen.

brown, septate, 47.5-65×3.5-6 μ m Conidia solitary or in short chains, brown to dark brown, obpyriform, ellipsoid or ovoid, with 3-6 transverse septa and 2-4 longitudinal or oblique ones, rostrate, spore bodies 19.5-47 ×12-25 μ m. Rostra cylindrical or conical, slightly swollen at apexes, 8-24×3.5-5 μ m.

This fungus is the first species of *Alternaria* reported on Fagaceae causing distinct leaf spots. It can be readily distinguished from the wide spread species, *A. alternata* and *A. tenuissima* by its obpyriform-ovoid (relatively wider) conidia.

Alternaria liriodendri T. Y. Zhang et J. Z. Zhang, sp. nov. Fig.2

Maculae suborbiculares, 4-8 mm diam., brunneae. Caespituli hypophylli. Conidiophora solitaria vel fasciculata, brunnea, erecta, recta vel geniculata, ramosa vel non ramosa, septata, 27-54×3-5 μ m .Conidia solitaria, ovoidea, ellipsoidea vel late obclavata, flavo-brunnea, 3-5 transverse septata, 0-2 longitudinaliter septata, leviter constricta, 22-41×8-18 μ m. Rostra non vel triangulariter subulata, interdum cylindrica, brevia, 5-12×2-3.5 μ m.

Hab. in foliis vivis *Liriodendri chinensis* (Hemsl.)Sarg. (Magnoliaceae), Xian, Shaanxi Provincia,29 IX 1993, Leg. Zhang JZ&Wang J (no. ZW93-210), HSAUP 950115, Holotypus.

Leaf spots suborbicular, 4-8 mm in diam., brown. Fruiting mainly hypophyllous. Conidiophores solitary or fasciculate, erect, straight or geniculate, brown, occasionally branched, septate, 27-54 × 3-5 μ m. Conidia solitary or occasionally in short chains, ovoid, ellipsoid or thickly obclavate, yellowish brown, with 3-5 transverse septa and 0-2 longitudinal or oblique ones, slightly constricted at septa, spore bodies 22-41×8-18 μ m. Rostra: beakless or with conical or occasionally short cylindrical beaks, 5-12×2-3.5 μ m.

Alternaria tenuissima* (Fr.)** Wiltshire f. sp. ***magnoliicola T. Y. Zhang et X.. L. Ma Fig. 3

Leaf spots irregular, light brown. Fruiting amphigenous. Conidiophores solitary or fasciculate, erect, straight or geniculate, brown, branched or unbranched, septate, 34-80×4-5 μ m. Conidia solitary or in short chains, obclavate, yellowish brown, with 5-7 transverse septa and 2-7 longitudinal or oblique ones, constricted at septa, often have a median transverse septum that is darker and more constricting than other septa are, rostrate, spore bodies 30-53.5×10.5-15.5 μ m. Rostra cylindrical, septate, 21.5-46×2.5-4 μ m.

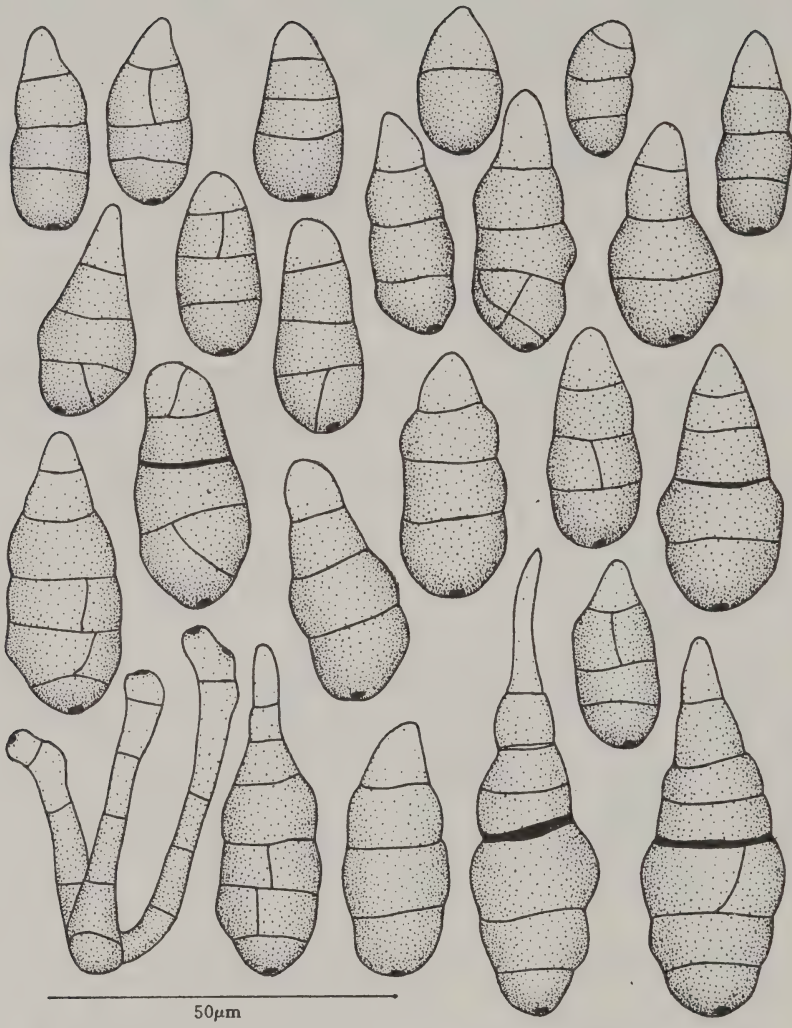

Fig.2. Conidia and conidiophores of *Alternaria liriodendri* T. Y. Zhang et J. Z. Zhang

Hab. on leaf spots of *Magnolia denudata* Desr., (Magnoliaceae), Jinan, Shandong Province, 28 IX 1995, coll. Chen Y & Gao MX (no. CG95-133), HSAUP 950531.

There is a "C. Roumeguere Fungi selecti exsiccati, no. 5595." named "*Macrosporium Magnoliae* Therry in Herbor. Cryptog. ined." in Herb. Kew (type material). One of us (T. Y. Zhang, 1991) had made a slide from it and checked microscopically. He failed to find anything like

'*Macrosporium*' sp. on the specimen, but a mixture of *Spiropes* sp. and *Gyrothrix* sp.. *A.liriodendri* and *A. tenuissima* f. sp..*magnoliicola* should be the species of *Alternaria* reported for the first time on Magnoliaceae. They are distinguishable each other in conidial shape and size. Since the

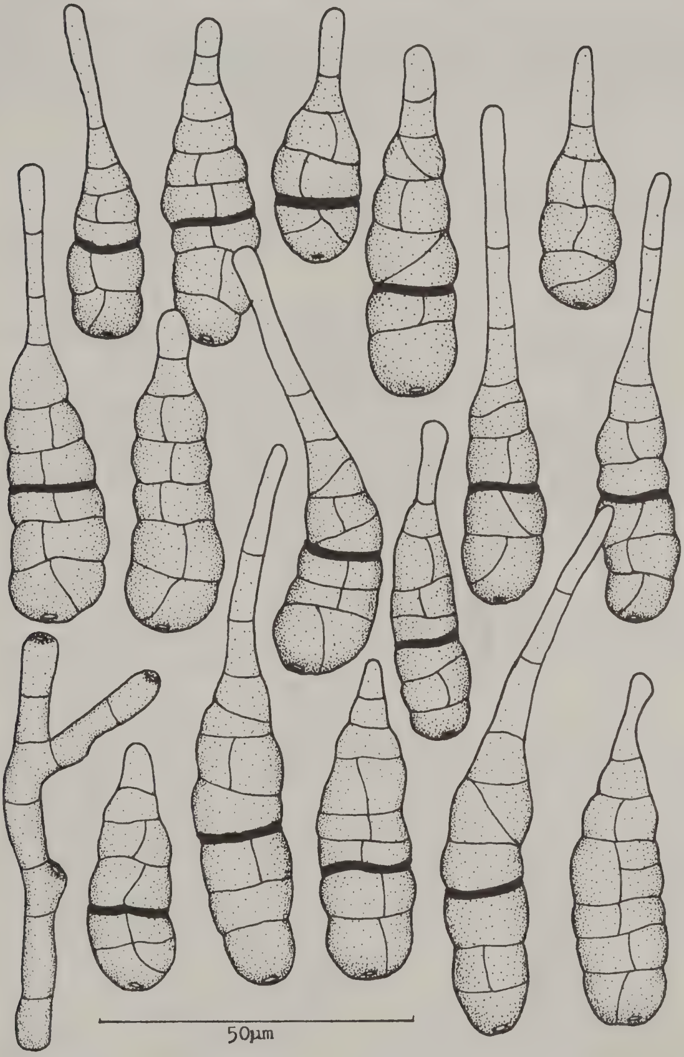

Fig.3. Conidia and conidiophores of *Alternaria tenuissima* f. sp *magnoliicola* T.Y. Zhang et X. L. Ma

latter fungus is morphologically alike *A. tenuissima* (Fr.) Wiltshire but often causes distinct leaf spots of *Magnolia denudata*, we reeat it as a new forma specialis of the species.

Alternaria tenuissima **(Fr.)** Wiltshire f. sp. ***toonae*** T. Y. Zhang et X. L. Ma Fig. 4

Leaf spots irregular, yellowish brown. Fruiting mainly hypophyllous. Conidiophores solitary or fasciculate,, erect, straight or geniculate, pale brown, septate, 45.5-90× 4-5 μ m. Conidia solitary or in short chains, obclavate or ellipsoid, yellowish brown, with 4-7 transverse septa and 3-6

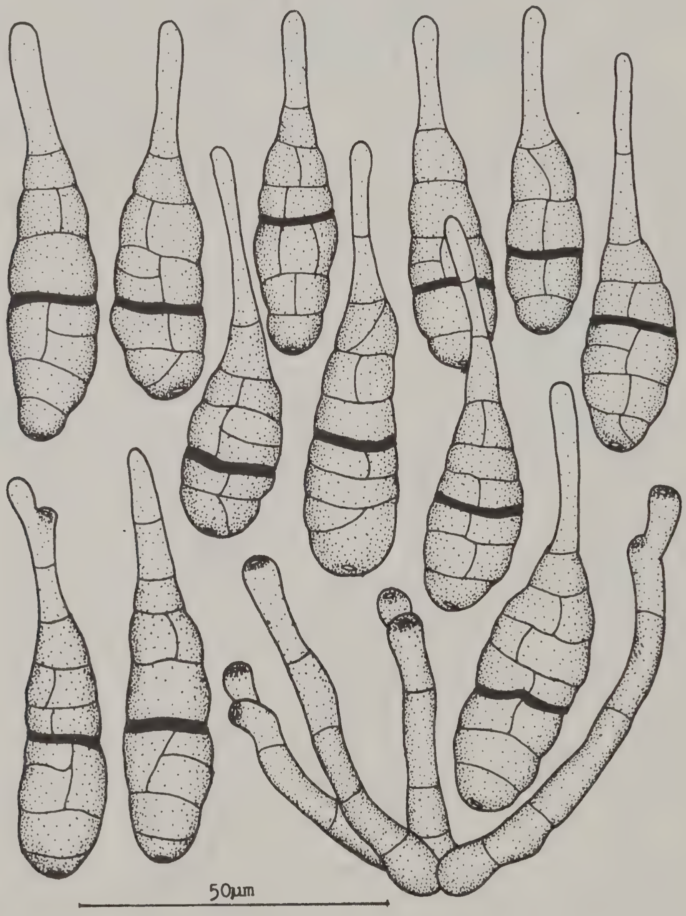

Fig. 4. Conidia and conidiophores of *Alternaria tenuissima* f. sp. *toonae* T. Y. Zhang et X. L. Ma

longitudinal or oblique ones, slightly constricted at septa, often with a median septum that is darker and more constricting than are other septa, rostrate, spore bodies 38.5－47.5×12－15.5 μ m. Rostra cylindrical, with 0-2 septa, 15.5-25×2-5 μ m.

Hab. on leaf spots of *Toona sinensis* (A. Juss) Roem. (Meliaceae), Taian, Shandong Province, 23 Ⅸ1995. Coll. Chen Y& Gao MX (no.CG95-059), HSAUP 950460, ; Taian, Shandong Province, 2 Ⅺ 1996, Coll. Zhang TY (no. ZTY96-116), HSAUP 960002.

This fungus is the first species of *Alternaria* reported on Meliaceae. Since it morphologically resembles to *A. tenuissima* (Fr.) Wiltshire but often causes distinct leaf spots of *Toona sinensis*, we treat it as a forma specialis of the latter.

Alternaria broussonetiae T. Y. Zhang, W. Q. Chen et M. X. Gao, sp.vov. Fig.5

Maculae suborbiculares vel irregulares, penitus flavo-brunneae, 0.2-1 cm diam., confluentes. Caespituli imprimis epigeni. Conidiophora solitaria vel fasciculata, brunnea, erecta, recta vel curvata, geniculata, 27.5-90.5×4-5 μ m .Conidia solitaria vel catenuata, flavo-brunnea, obclavata, longe obclavata vel longe ellipsoidea, 3-7 transverse septata, 1-6 longitudinaliter vel oblique septata, centro septata distincte incrassata, atro-brunnea, 19-40.5×8.5-13(-16.5) μ m .Rostra 12.5-27.5×2.5-4 μ m, pseudorostra 9-105.5×2.5-4 μ m.

Hab.in foliis vivis *Broussonetiae papyriferae* (L,) Vent. (Moraceae), Changqing, Shandong Provincia, 13 Ⅸ 1996, leg. Zhang TY (no.ZTY96-074), HSAUP 96074, Holotypus.

Leaf spots sub-orbicular or irregular, grayish brown in the central area, always with dark brown margin, 0.2-1 cm in diam., confluent. Fruiting mainly epigenous. Conidiophores fasciculate or solitary, erect, straight or slightly curved, brown, 27.5-90,5×4-5 μ m. Conidia solitary or in short chains, yellowish brown, obclavate, long obclavate or long ellipsoid. with 3-7 transverse septa, 1-6 longitudinal or oblique septa, 1 to several central septa thicker and darker, spore bodies 19-40.5×8.5-13(-16.5) μ m. Rostra 12.5-27.5×2.5-4 μ m, pseudorostra 9-105.5×2.5-4 μ m.

This fungus can be differentiated from *A.fici* Farneti (1904) reported on the same plant family by size of spore bodies and conidial septation. Conidia of the later are much bigger (36-71×10-20 μ m, excluding beaks) than that of *A.broussonetiae* and remarkably constricted at septa.

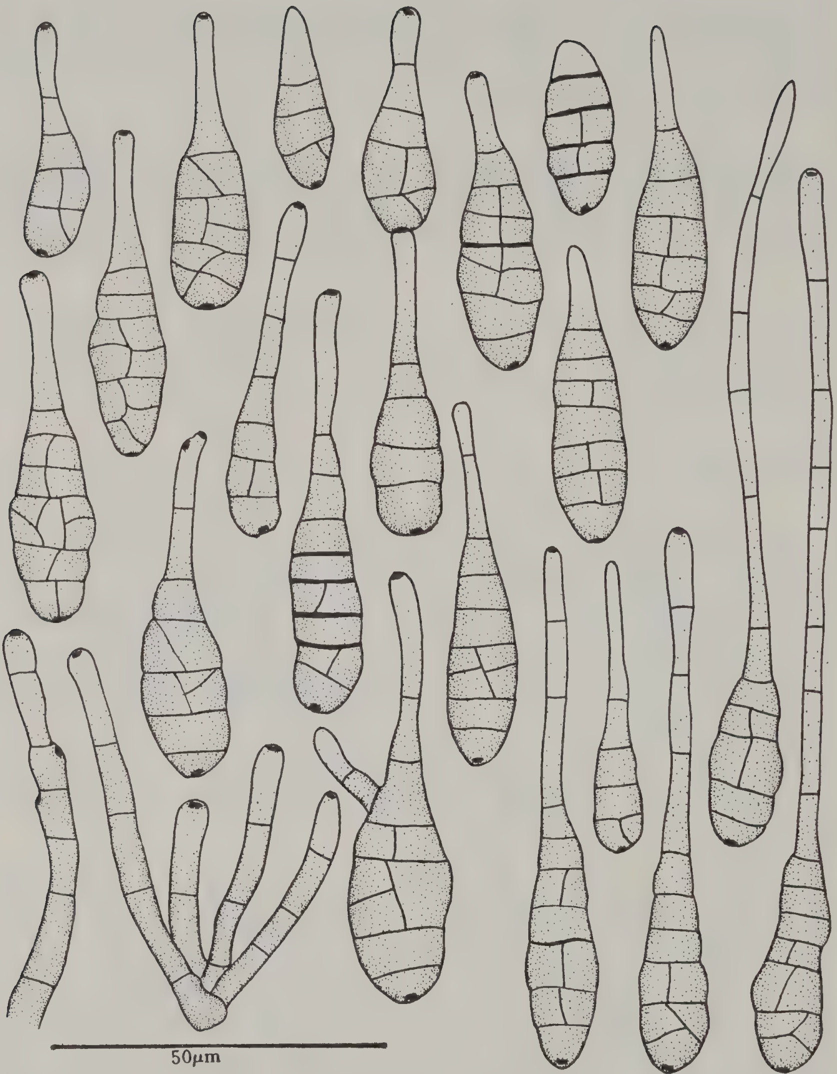

Fig.5. Conidia and conidiophores of *Alternaria broussonetiae* T. Y. Zhang, W. Q. Chen et M.X.Gao

ACKNOWLEDGEMENTS: The authors are grateful to Professor Kong HZ and Professor Bai JK for reviewing the manuscript. We acknowledge Prof. Guo YL for preparing the latin diagnoses. Thanks are due to Miss Chen Y and Miss Wang J for collecting some specimens and to Mr. Meng FC for inking the line drawings.

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中国链格孢（ALTERNARIA）分类研究

Ⅶ.生于壳斗科、木兰科、楝科及桑科植物上的新分类单位*

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摘要 本文报道 3 个链格孢新种和 2 个新专化型，即：生于壳斗科(Fagaceae)植物上的栎链格孢(*Alternaria querci*)、生于木兰科（Magnoliaceae）植物上的鹅掌揪链格孢（*A. liriodendri*），及细极链格孢玉兰专化型（*A. tenuissima* f. sp. *magnoliicola*)、生于楝科（Meliaceae）植物上的细极链格孢香椿专化型(*A. tenuissima* f. sp. *toonae*)、及生于桑科(Moraceae)植物上的构链格孢(*A. broussonetiae*)。文中的新种均有拉丁文描述和绘图。新种的模式标本保藏在山东农业大学植物病理标本室（HSAUP)。

关键词 栎链格孢 鹅掌楸链格孢 构链格孢 细极链格孢玉兰专化型 细极链格孢香椿专化型

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TAXONOMIC STUDIES OF ALTERNARIA FROM CHINA
Ⅷ. NEW SPECIES AND NEW RECORDS ON GRAMINEAE, IRIDIACEAE, AND LILIACEAE[*]

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ABSTRACT 4 new species, 1 new variety and 2 new records to China in the genus *Alternaria* are reported in this paper. They are: *A. brevispora* T. Y. Zhang, sp. nov. and *A. setariae* T. Y. Zhang, sp. nov. on Gramineae; *A. eleuthrines* T. Y. Zhang, sp. nov. on Iridiaceae; *A. obpyriformis* T. Y. Zhang, sp. nov., *A. tenuissima* (Fr.) Wiltsh. Var. *alliicola* T. Y. Zhang v. nov., *A. palandui* Ayyangar, new rec., and *A. asphodeli* Olga Savulescu, new rec. on Liliaceae. Latin diagnoses and illustrations of the new species are provided. The type specimens of new species are diposited in HSAUP and Mycological Herbarium of Northwestern Agricultural University (HMUABO), respectively.

KEY WORDS *Alternaria brevispora, A. setariae, A. obpyriformis, A. eleuthrines A. tenuissima var. alliicola*

TAXA ON GRAMINEAE

Alternaria brevispora T. Y. Zhang, sp. nov. Fig 1

Etym: Latin, 'brevispora' means that the spore are relatively shorter and thicker, referring to the conidium shape of the type.

Maculae longe ellipticae, flavo-brunneae. Caespituli epigeni. Conidiophora solitaria vel fasciculata, pallide brunnea, erecta, recta vel geniculata, ramosa vel non ramosa, septata, 39.5-86.5×3.5-5.5 μ m. Conidia solitaria vel breviter catenuata, brunneola, obpyriformia vel late ellipsoidea, 3-5 (-7) transverse septata, 1-6 (-9) longitudinaliter

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[*] Supported by the NSFC.

vel oblique septata, centro 1-2 septata distincte incrassata, 25-45.5×13-20.5 μ m. Rostra non vel cylindrica vel triangulariter subulata, 4.5-18×3.5-4.5 μ m.

Hab. in foliis vivis *Tritici aestivi* L., Yangling, Shaanxi Porvincia, 25 V 1996, Leg. Zhang TY, (no. ZTY96-118), HSAUP 960308, Holotypus.

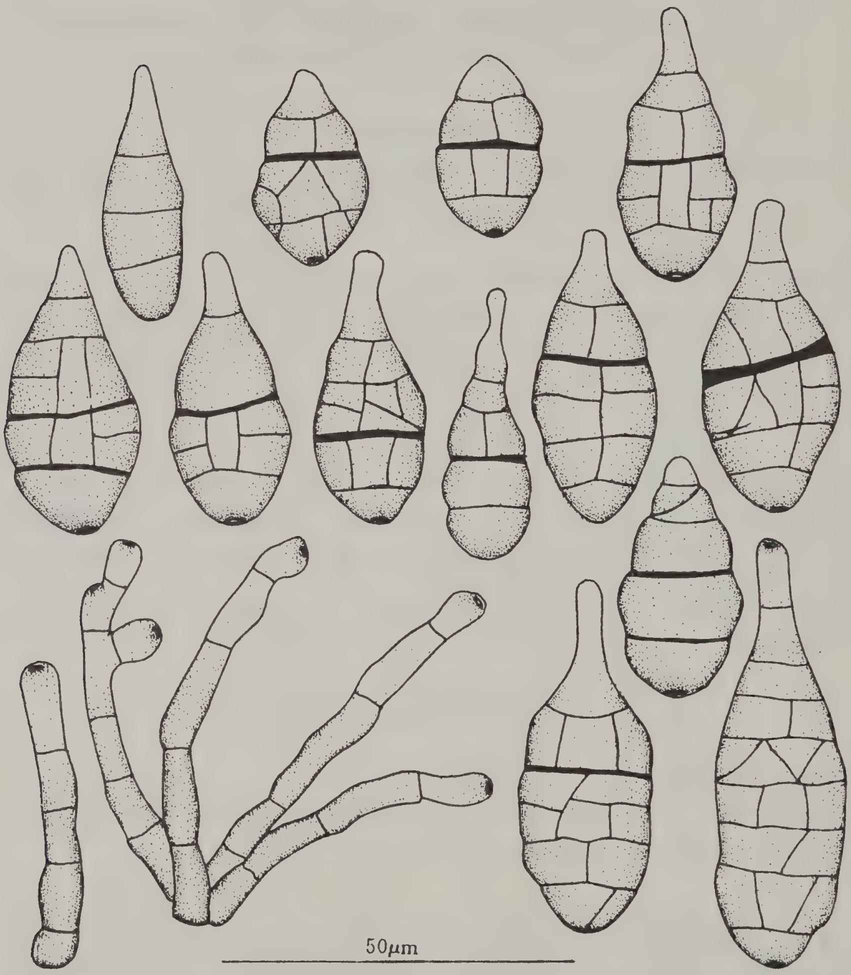

Fig.1. Conidia and conidiophores of *Alternaria brevispora* T. Y. Zhang

Leaf spots long elliptical, light yellow or light brown. Fruiting mainly epigenous. Conidiophores solitary or fasciculate, pale brown, branched or unbranched, septate, erect, straight or geniculate, 39.5-86.5×3.5-5. 5 μ m. Conidia solitary or in short Chains, obpyriform or broad ellipsoid, pale brown, with 3-5 (-7) transverse septa, 1-6 (-9) longitudinal or oblique septa, the central 1-2 septa often thicker and darker than other septa are, Spore bodies 25-45.5×13-20.5 μ m.. Rostra: beakless or with cylindrical or conical rostra or pseudorostra, 4.5-18×3.5-4.5 μ m.

The most closely related species in conidial shape and size are *A. alternata* (Fr.) keissler (Simmons, 1967) and *A. oryzae* Hara (Hara, 1928) on gramineae. The new taxon can be separated form the two species by conidial shape and the ratio of L/W of the conidia. Most conidia of *A. brevispora* are obpyriform wheras that of the other two species are mostly obclavate. Relatively thicker and shorter conidia (L/W=1.92-2.12) readily permit its differentiation form *A. alternata* and *A. oryzae* (L/W=1.7-3.4 and 2.4-3.46, respectively).

Alternaria setariae T. Y. Zhang, sp. nov. Fig. 2

Maculae ellipticae vel longe ellipticae, pallide brunneae. Caespituli epigeni. Conidiophora solitaria pallide brunnea, erecta, recta vel curvata, non ramosa, septata, 47.5-64.5×3.5-4.5 μ m. Conidia solitaria, interdum catenuata, infuscata vel modice brunnea, longe ellipsoidea vel obclavata, 3-7 transverse septata, 1-7 longitudinaliter vel oblique septata, centro septata distincte incrassata, constricta, 16-35.5×9.5-14 μ m. Rostra longe cylindrica, septata, 11-133.5×2.5-3.5 μ m.

Hab. in foliis vivis *Setariae italicae* (L.) Beauv., Yangling, Shaanxi Provincia, 10 IX 1994, Leg. Zhang TY. (no. ZTY94-004) HSAUP 950871, Holotypus.

Leaf spots elliptical or long elliptical, pale brown. Fruiting mainly epigenous. Conidiophores solitary, erect, straight or curved, septate, pale brown, unbranched, 47.5-64.5×3.5-4.5 μ m. Conidia solitary or rarely in short chains, long ellipsoid or obclavate, pale brown or mid borwn, with 3-7 transverse septa and 1-7 longitudinal or oblique ones, the central septum often thicker and constricted, rostrate, spore bodies 16-35.5×9.5-14 μ m. Rostra and pseudorostra long cylindrical, septate, very light brown or hyaline, 11-133.5×2.5-3.5 μ m.

A.setariae differs from all the species of *Alternaria* discribed on plants in gramineae in its long cylindrically beaked conidia. The new taxon is

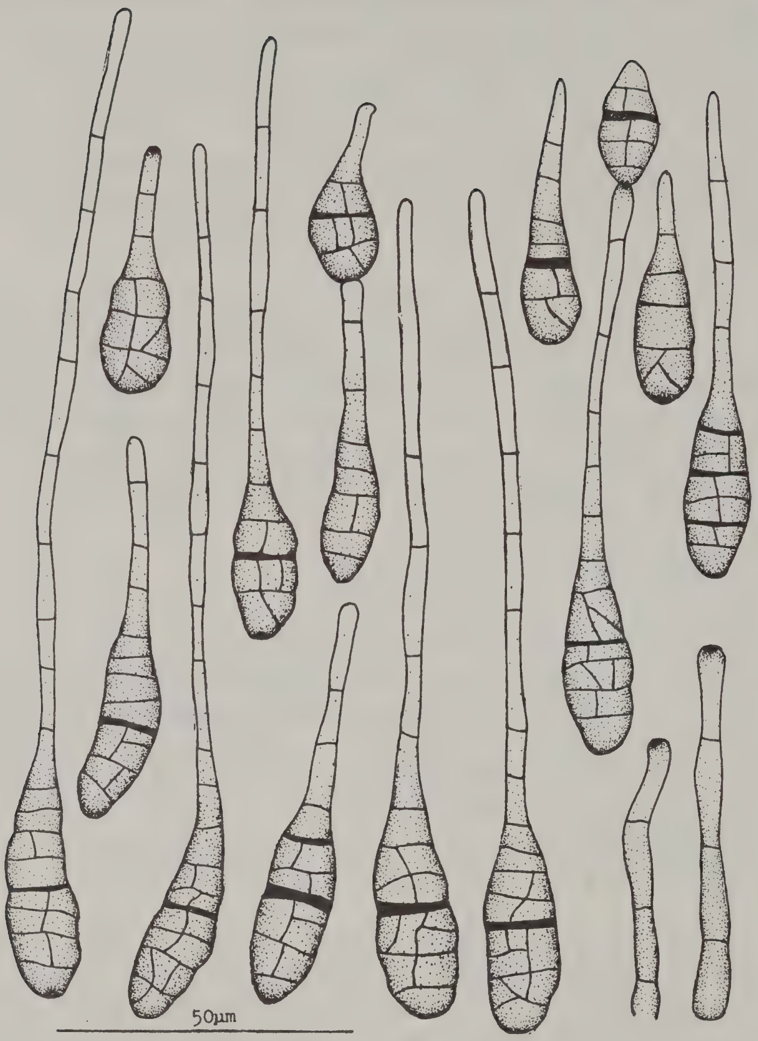

Fig.2. Conidia and conidiophores of *Alternaria setariae* T. Y. Zhang

somewhat similar to the graminicolous species, *A. triticina* Prasada et Prabhu (1963) in morphology of obclavate-shaped conidium, but the much small size of its conidial body in *A. setariae* (16-35.5×9.5-14 μ m) provides a very useful character in distinguishing it from the latter (47-64×15-19 μ m).

TAXON ON IRIDIACEAE

Alternaria eleuthrines T. Y. Zhang, sp. nov. Fig.3

Maculae longe ellipticae vel longe fasciata, pallide brunnea vel atro-brunnea. Caespituli amphigeni. Conidiophora solitaria, infuscata, erecta, recta vel geniculata, 25-64×3.5-4.5 μ m. Conidia solitaria vel breviter catenuata, pallide flavo-brunnea vel brunnea, obclavata vel anguste ovoidea, laevia, 4-7 transverse septata, 1-6 longitudinaliter vel oblique septata, 20-36 × 8.5-12 μ m.. Rostra cylindrica vel acicularia,non septata vel septata, subhyalina vel pallide brunnea, 15-35.5×2-3.5 μ m.

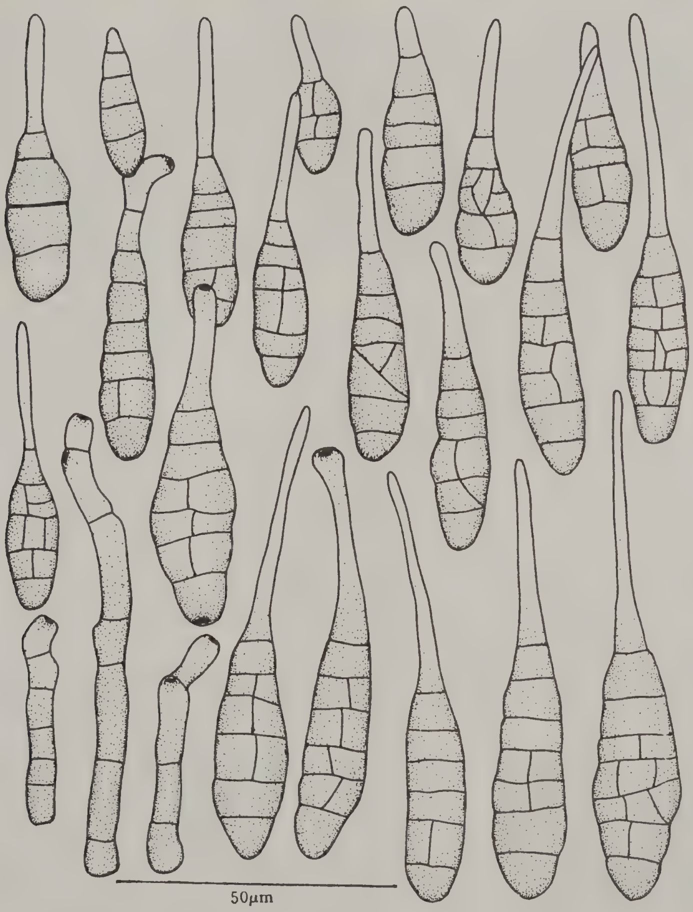

Fig.3. Conidia and conidiophores of *Alternaria eleuthrines* T. Y. Zhang

Hab. In foliis vivis *Eleuthrines americanae* Merr. ex Meyne, Nanning, Guangxi Porovincia, 24 X 1991, leg. Zhang TY, HMUABO 100306a.

Leaf spots long elliptical or strip shaped, light brown to mid brown. Fruiting amphigenous. Conidiophores solitary, erect, straight or geniculate, pale brown, 25-64×3.5-4.5 μ m. Conidia solitary or in short chains, obclavate or long ovoid, yellowish brown to mid brown, surface smooth, with 4-7 transverse septa and 1-4(-6) longitudinal or oblique ones, spore bodies 20-36 × 8.5-12 μ m. Rostra cylindrical, narrower toward apexes, mostly aseptate, hyaline or very pale brown , 15-35.5×2-3.5 μ m.

This fungus bears a close resembalance to *A.alternata* (Fr.) Keissler in conidial morphology and size. But the conidial beak length of the latter is much shorter than that of the new taxon, "never equaling the length of the conidium body but commonly representing one-fourth to one-third of the total conidium length"(Simmons, 1967). The feature of *A. eleuthrines* with longer conidium beak which almost equals the length of the conidium body and its obvious pathogenicity to the host causing distinct leaf spots provide the most useful characters in sepatating it form *A. alternata* (Fr.) Keissler.

TAXA ON LILIACEAE

Alternaria obpyriformis T. Y. Zhang, sp. nov. Fig.4.
Etym.: Latin, obpyriformis, referring to the conidial shape of the type.

Maculae ellipticae vel suborbiculares, 3-7 mm diam., atro-brunneae. Caespituli amphigeni. Conidiophora solitaria vel fasciculata, pallide brunnea, erecta, recta vel geniculata, 35-77.5×4.5-5.5 μ m. Conidia solitary vel breviter catenuata, brunnea, obpyriformia vel obclavata, 4-7 transverse septata, 2-7 longitudinaliter vel oblique septata, leviter constricta, 27-43.5×12-22.5 μ m. Rostra cylindrica, septata vel non septata, parte ad apicem sufflata, 14-36×2-2.5 μ m.

Hab. in foliis vivis *Aloes verae* var. *chinensis* (Haw.) Berg., Nanning, Guangxi Provincia, 25 X 1991, Leg. Zhang TY(no. 100317), HSAUP 950872, Holotypus.

Leaf spots elliptical or suborbicular, dark brown, 3-7mm in diam. Fruiting amphigenous. Conidiophores solitary or fasciculate, erect, straight or geniculate, pale brown, 35-77.5 × 4.5-5.5 μ m .Conidia solitaria or in short chains, obpyriform or obclavate, borwn, with 4-7 transverse septa and 2-7 longitudinal or oblique septa, slightly constricted at septa, spore bodies 27-43.5×12-22.5 μ m. Rostra cylindrical, septate or aseptate, some of them swollen at apexes, 14-36×2-2.5 μ m.

This fungus differs from all the species of *Alternaria* reported (Ayyangar, 1928; Ciferri, 1930; Savulescu, 1968) on Liliaceae by its Characteristic conidial morphology.

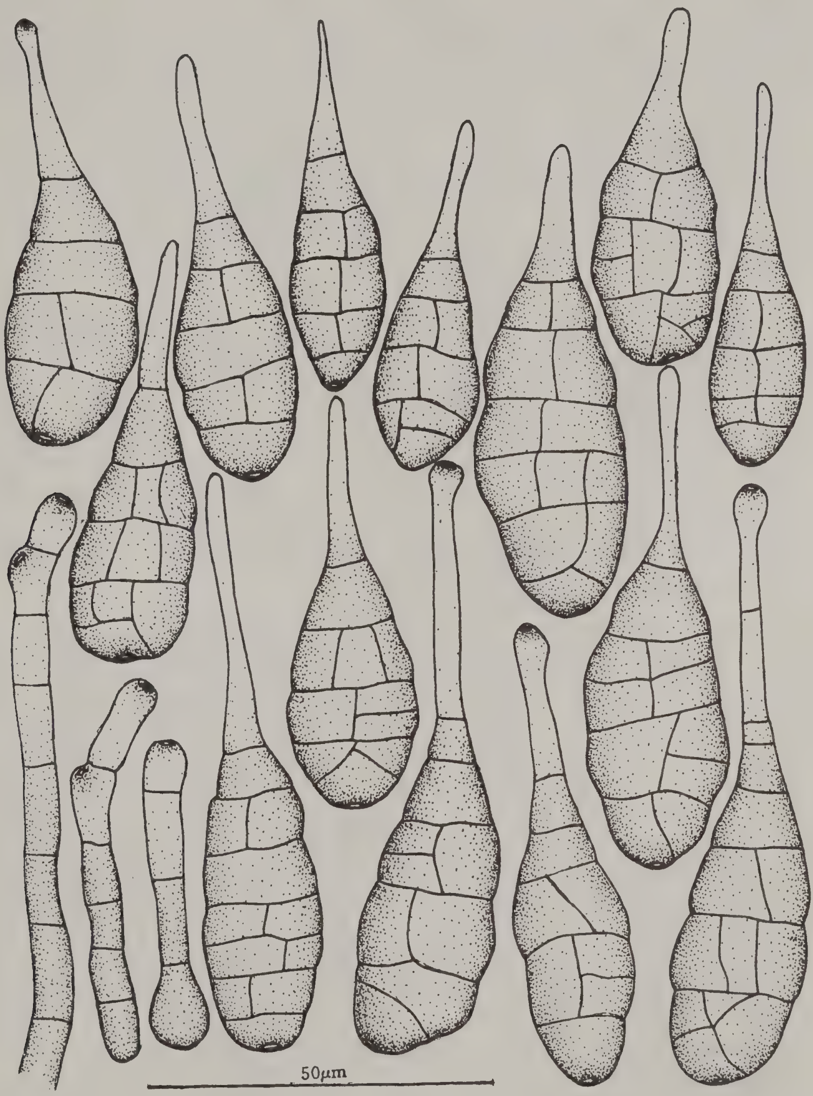

Fig.4. Conidia and conidiophores of *Alternaria obpyriformis* T. Y. Zhang

Alternaria tenuissima (Fr.) Wiltshire var. ***alliicola*** T. Y .Zhang, var. nov.
Fig. 5

Maculae ellipticae vel irregulares, brunneolae. Caespituli amphigeni. Conidiophora solitaria vel fasciculata, erecta, recta vel geniculata, infuscata, ramosa vel non ramosa, 18.5-90 × 4-5.5 μ m.. Conidia solitaria vel breviter catenuata, flavo-brunnea, obclavata vel longe ellipsoidea, recta vel curvata, verrucolosa, 3-8 trasverse septata, 2-6 longitudinaliter septata, leviter constricta, mid septa magis constricta et fuscata, 28-56×10.5-16.5 μ m.. Rostra vel peseudorostra cylindrica, brunneola vel hyalina, 5-50.5×2-4.5 μ m.

Hab. in foliis vivis *Allii sativi* L., Taian, Shandong provincia, 30 V 1996, leg. Zhang TY (no. 96013), HSAUP 960014, Holotypus; Zhengzhou, Henan provincia, 29 V 1998, Leg. Zhang TY (no. 98025), HSAUP 980025; in foliis vivis *Allii macrostemoni* Bunge, Xian, Shaanxi Provincia. 24 IX 1993, leg. Zhang JZ & Wang J (no. ZW 93-114), HSAUP 950081.

Leaf spots elliptical or irregular, light brown. Fruiting amphigenous. Conidiophores solitary or fasciculate, erect, straight or geniculate, pale brown, proliferating eb-tret., extending sympodially, 18.5-90×4-5.5 μ m. Conidia solitary or in short chains, yellowish brown, obclavate or long ellipsoid, straight or slightly curved, verrucolosus, with 3-8 transverse septa and 2-6 longitudinal or oblique ones, slightly constricted at septa, often have a median transverse septam that is darker and more constricting than are other septa, spore bodies 28-56×10.5-16.5 μ m. Rostra and pseudorostra cylindrical, very light brown or hyaline, often swollen at the tip, 5-50.5×2-4.5 μ m.

This fungus belongs to *A. tenuissima* (Fr.) Wiltshire (1933) according to its conidial shape and size, particularly the character of the median conidial trans-septa which is often darker and more constricting than other septa are. *A. tenuissima* has been found occurring on varions plant materials belonging to many families, though it was originally found on petals of *Dianthus* sp. or *Ranunculus asiaticum* (?) (Wiltshire. 1933), and is very widespread in nature. Its further taxonomic study at species and/or subspecies level needs to be carried out. So far two varieties and three "group" species have been published by Neergaard (1945), Chowdhury (1966) and Simmons (1990, 1993), respectively. This new variety differs from the main species in having longer conidial beak and verrucolose surface of conidium. In the main species the beak "occupies about one-third of the spore length" (Wiltshire, 1933) or "may attain the same length as the spore body" (Neergaard, 1945), the conidium with a smooth surface. *A. tenuissima* var. *allii* differs from *A. tenuissima* var. *godetiae* (Neergaard, 1945) in having verrucolose conidium surface, from *A. tenuissima* var. *verrucolosa* (Chodhury, 1966) in having relatively long conidium beak, whereas the latter two varieties with smooth conidium surface and comparatively short conidium beak, respectively. The new variety occurs on *Allium* spp. (Liliaceae), while Simmons's "group" species 1,2" (1990) occur on *Citrus sinensis* and "species 3" (1993) occurs on *passiflora* sp. (passifloraceae), respectively.

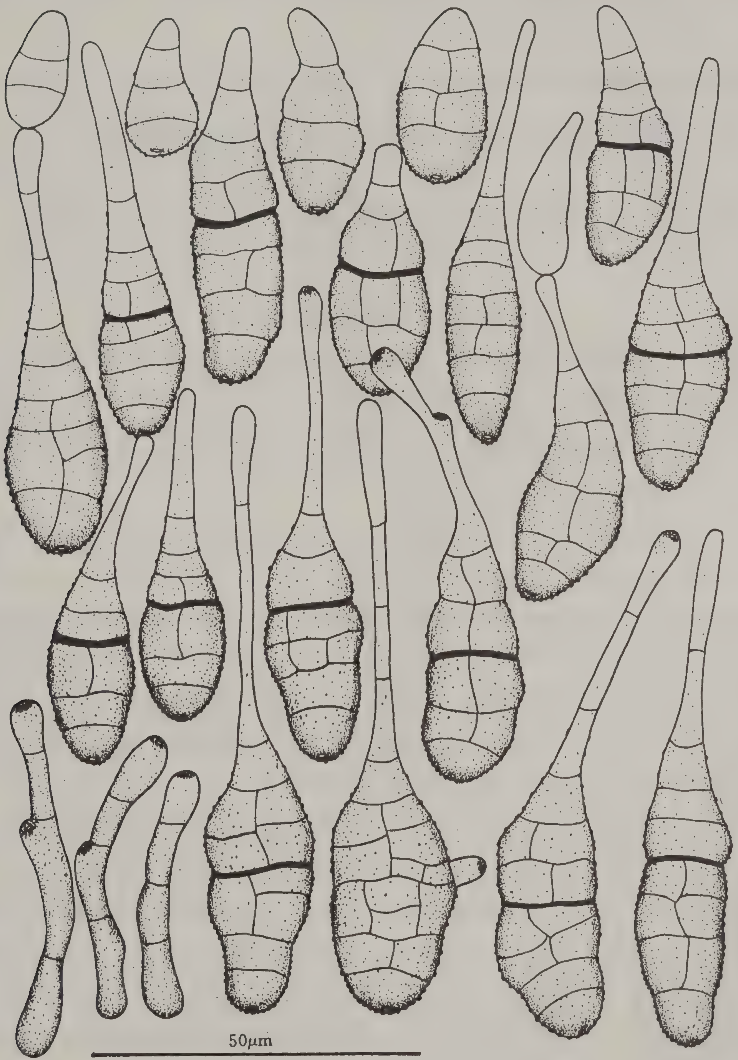

Fig. 5. Conidia and conidiophores of *Alternaria tenuissima* (Fr.) Wiltsh. var. *alliicola* T. Y. Zhang

The following two species are new records to China:

Alternaria palandui Ayyangar, Agric. Res. Inst.Pusa Bull. no. 179,1928.
on *Allium fustulosum* L., Taian, Shandong Province, 7 Ⅶ 1992, coll. He YS (no. He920707), HSAUP 950912.

Alternaria asphodeli Olga Savulescu, Herb. Mycol. Romanicum, P.769, no. 1488, 1968.

On *Hosta plantaginea* (Lam.) Aschers, Xian, Shaanxi province, 28 Ⅸ 1993, coll. Zhang JZ & Wang J (no. ZW 93-176), HSAUP 950104;

On *Polygonatum sibiricum* Delar, Jinan, Shandong Province, 8 Ⅹ 1995, Coll. Chen Y & Gao MX (no. CG 95-231), HSAUP 950630.

ACKNOWLEDGEMENTS

The author is grateful to Professor Kong HZ and Professor Bai JK for reviewing the manuscript and to Prof. Guo YL for preparing the latin diagnoses and Mr. Meng FC for inking the line drawings. Thanks are due to Mr. Zhang JZ, Miss Wang J, Miss Ma XL, Miss Chen Y and Miss Gao MX for collecting some specimens.

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Prasada, R. & A, S. Prabhu (1963). Leaf blight of wheat caused by a new species of *Alternaria*. Indian phytopath. **15** (3-4): 292-293.

Saccardo, P. A. (1886), *Macrosporium porri* J. B. Ellis, Sylloge Fungorum IV : 537. (basionym of *Alternaria porri* (Ellis) Ciferri, 1930.)

Savulescu, T.(1968). *Alternaria asphodeli* Olga Savulescu. Herb. Mycol. Romanicum “ TR.Savulescu” . P.769. no. 1488.

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Simmons, E. G. (1990). Alternaria Themes and Variations (27-53). Mycotaxon, **37**: 98-100, Fig. 46; 100-102, Fig. 47.

Simmons, E. G. (1993). Alternaria Themes and Variations (54-62). Mycotaxon, **46**: 189-191, Fig. 58.

Wiltshire, S. P. (1933). The foundation species of *Alternaria* and *Macrosporium*. Trans. Br. Mycol. Soc., **18**: 138-142, 157-158.

中国链格孢(ALTERNARIA)分类研究

Ⅷ.生于禾本科、鸢尾科与百合科植物上的新种和新记录种*

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摘要 本文报道链格孢属(*Alternaria*)真菌的 4 个新种、1 个新变种和 2 个中国新记录种。它们是：生于禾本科(Gramineae)植物上的短孢链格孢(*A. brevispora* T.Y. Zhang, 新种)和粟链格孢(*A. setariae* T.Y.Zhang, 新种)，生于鸢尾科（Iridiaceae）植物上的红蒜链格孢(*A. eleuthrines*, 新种)，和生于百合科（Liliaceae）植物上的倒梨形链格孢(*A. obpyriformis* T.Y.Zhang, 新种)，细极链格孢蒜生变种(*A. tenuissima* (Fr.) Wiltsh. var. *alliicola* T.Y. Zhang, 新变种)、梵葱链格孢(*A. palandui* Ayyangar, 新记录种)、和日光兰链格孢(*A. asphodeli* Olga Savulescu, 新记录种)。文中的新种和新变种均有拉丁文描述和绘图。新分类单位的模式标本分别保藏在山东农业大学植物病理标本室(HSAUP)和西北农业大学真菌标本室（HMUABO)。

关键词 短孢链格孢 粟链格孢 倒梨形链格孢 红蒜链格孢 细极链格孢蒜变种

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VENUSTUSPORIUM, A NEW GENUS OF HYPHOMYCETES FROM VENEZUELA

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ABSTRACT

Venustusporium chelysforme gen. & sp. nov. found in a rainforest on rotted leaves of *Bactris setulosa* Karsten, is described and illustrated. This genus is characterized by muriform, turtle-shaped, discoid to flattened, pale brown to brown, conidia with interesting uncinate to corniform peripheral ornamentation. The new taxon is compared with closely related genera.

Key words: *Venustusporium*, Hyphomycetes, leaf litter, systematics, tropical fungi, Venezuela.

During studies of leaf litter fungi in Venezuela, we have encountered a fungus with sporodochial pulvinate or effuse conidiomata, and lenticular, muriform, turtle-like conidia which cannot be assigned to any described genus. We describe it here as new.

TAXONOMIC PART

Venustusporium R. F. Castañeda et Iturriaga, anam. gen. nov. Figs. 1-7.

Entymol. L. *Venustusporium* the generic name refers to the beautiful shape of the conidia.

Ad fungos conidiales, hyphomycetes pertinens. ***Conidomata*** *in substrato naturali sporodochialia, superficialia, brunnea, olivacea vel nigra.* ***Mycelium*** *partim superficiale et partim immersum.* ***Conidiophora*** *inconspicua, plerumque in cellula conidiogena reducta.* ***Cellulae conidiogenae*** *monoblasticae, discretae, determinatae.* ***Conidiorum secessio*** *schizolytica.* ***Conidia*** *solitaria, muriformia cum septis transversis, longitudinalis et obliquis praedita; lenticularia cum nonnullis prominentis uncinatis, acerosis vel cornutis cellulis in peripheria unica lamina confecta; holoblastica, olivacea, pallide brunnea, brunnea vel atrobrunnea.*

Species typica: ***Venustusporium chelysforme*** anam. sp. nov.

Conidial fungus, Hyphomycetes (Mitosporic fungi).
Conidiomata on natural substrate sporodochial, superficial, olivaceous, brown to dark brown. Mycelium superficial and immersed. **Conidiophores** undifferentiated, reduced to conidiogenous cells. **Conidiogenous cells** monoblastic, discrete, determinated. **Conidial secession** schizolytic. **Conidia** solitary, muriform, with longitudinal, transverse and oblique septa, lenticular, with a layer of uncinate cells, needle-like to horn-like projections around the periphery, holoblastic, olivaceous, pale brown, brown to dark brown.
Type species: ***Venustusporium chelysforme,*** anam. sp. nov.

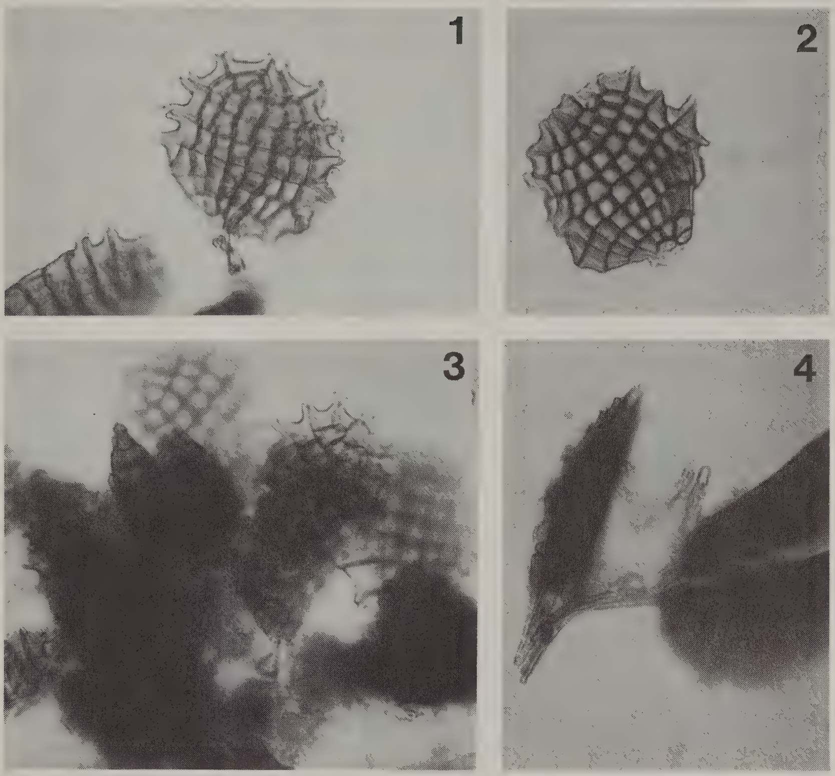
Venustusporium resembles superficially ***Canalisporium*** Nawawi and Kuthub. (1989). The later is distinguished by developed sporodochia without stromata and producing muriform, with 1-4 longitudinal clearly spaced and several transverse septa, without oblique septa, flattened, olivaceous to dark brown conidia, which lack ornamentation at the periphery.

Venustusporium has schizolytic conidial secession, a feature which clearly distinguishes its taxon from the superficially similar genus ***Berkleasmium*** Zobel. In ***Berkleasmium***, conidial secession is apparently rhexolytic (Nawawi and Kuthubutheen, 1989), and the conidia are produced by percurrent proliferation (Wang, 1990). The manner of septal development is also distinct (Goos, 1969).

Venustusporium chelysforme R. F. Castañeda et Iturriaga, anam. sp. nov. Figs. 1-7.

Entymol. The prefix "chelys" in the specific epithet refers to the shape of the conidia, which resemble the shell of a genus of turtles (*Chelys fimbriata*) belonging to the order Chelonia; the suffix "forme" refers to "shape".

Ad fungos conidiales, hyphomycetes pertinens. ***Conidomata*** *in substrato naturali sporodochialia, dissita vel confluentia, pulvinata,, 200-600 µm diam., primo brunnea, tarde atrobrunnea.* ***Mycelium*** *partim superficiale et partim immersum, ex hyphis septatis, ramosis, pallide brunneis vel brunneis, laevibus, 2.0-3.5 µm diam. compositum.* ***Conidiophora*** *inconspicua, irregulariter ramosa, prostrata, septata, pallide brunnea, plerumque in cellula conidiogena reducta.* ***Cellulae conidiogenae*** *monoblasticae, discretae vel integratae, pallide brunneae, cylindricae usque ad ventricosa, subdoliiformis, laeves, 4-8 x 3-4 µm.* ***Conidiorum secessio*** *schizolytica.* ***Conidia*** *muriformia cum septis transversis, longitudinalis et obliquis praedita, chelonio-similia (animalia), lenticularia cum nonnullis prominentis uncinatis vel cornutis in peripheria unica lamina confecta; holoblastica, pallide brunnea vel brunnea, tenuitunicata, in universum 55-75 x 50-65 µm, ex cellula basali cuneiformis, pallide brunneis, 5-6 x 3.5-5.0 µm praedita. Telemorphosis ignota.*
Substratum: In foliis dejectis *Bactris setulosae* Karsten.
Habitat: In sylva pluvialis.



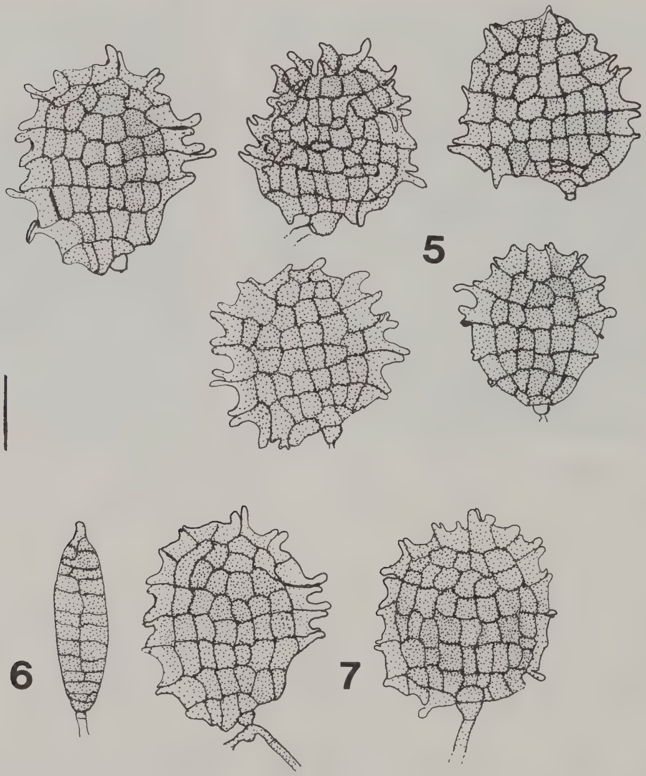
FIGS. 1–4. ***Venustusporium chelysforme.*** 1. Conidium attached to conidiogenous cell. 2. Detached conidium. 3. Sporodochium. 4. Lateral view of conidia. 1, 2 & 4 x 1000, 3 x 400.

HOLOTYPE: VENEZUELA, ESTADO ARAGUA: Camino de Interpretación de la Naturaleza "Andy Fields", Estación Biológica Rancho Grande, Parque Nacional Henry Pittier, 1200 m altitude. Leg. R. F. Castañeda & T. Iturriaga, 25. XI. 1997. MUCL 40692. ISOTYPES: VEN, USB (Herbarium of Universidad Simón Bolívar).

Conidial fungus, hyphomycetes. Conidiomata on natural substrate sporodochial, scattered to confluent, pulvinate, 200-600 µm diam., brown to dark brown. Mycelium superficial and immersed, composed of septate, pale brown to brown, smooth-walled, branched hyphae, 2.0-3.5 µm in diam. Conidiophores inconspicuous, branched, prostrate, septate, pale brown, mostly reduced to conidiogenous cells. Conidiogenous cells monoblastic, discrete and integrated, pale brown, cylindrical to ventricose, subdoliiform, smooth, 4-8 x 3-4 µm. Conidial secession schizolytic. Conidia muriform, with longitudinal, transverse and oblique septa, turtle-like in shaped, lenticular to flattened, with several uncinate to horn-like projections around the periphery, holoblastic, pale brown to brown, thin-walled, in general, 55-75 x 50-65 μm in size, basal cell cuneiform, pale brown, 5-6 x 3.5-5.0 μm Teleomorph: unknown.

Substrate: On fallen, rotted leaves of *Bactris setulosa* Karsten.
Habitat: Rainforest at Rancho Grande Biological Station, Andy Fields Nature Interpretation Path, Henry Pittier Nacional Park, 1200 m altitude, Aragua State, Venezuela.

Colonies on corn meal agar, mixed 1:1 with carrot extract, attained a diam. of 3 mm after seven days at 25° C, producing a dark brown mycelium without sporulation. Cultures from the holotype have been deposited at CBS, MUCL, USB, INIFAT.



FIGS. 5–7. ***Venustusporium chelysforme.*** 5. Five conidia 6. Lateral view of one conidium. 7. Two conidia showing attachment to conidiogenous cells. Scale bar = 20 μm.

Three described species of ***Canalisporium***, ***C. caribense*** (Hol.-Jech. & Mercado) Nawawi & Kuthub. (1989), ***C. pulchrum*** (Hol.-Jech. & Mercado) Nawawi & Kuthub. (1989) and ***C. elegans*** Nawawi & Kuthub. (1989) are compared herein.

COMPARATIVE TABLE OF DESCRIBED *Canalisporium* AND *Venustusporium* SPECIES

conidial characters	*C. caribense*	*C. elegans*	*C. pulchrum*	*V. chelysforme*
SHAPE	flattened, ellipsoidal to obovoid	flattened, subglobose	flattened, broad ellipsoidal	lenticular, turtle-like, lenticular
PIGMENTATION	brown to reddish dark brown	olivaceous brown to brown	olivaceous brown to brown	pale brown
LONGITUDINAL SEPTA	1	4 (-5)	2	5-8
TRANSVERSAL SEPTA	3-6	5-7	4-6 (-7)	6-9
OBLIQUE SEPTA	none	none	none	several
MARGINAL SURFACE	smooth	smooth	smooth	with a layer of horn-like to uncinate cells
SIZE	28-41 x 21-28 µm	32-47 x 27-35 µm	36-55 x 22-27 µm	55-5 x 50-65 µm
BASAL CELL	cuneiform, 5.0-5.5 x 3.0-3.5 µm	cuneiform, 4-6 x 4-5 µm	cuneiform, 4-6 x 4-5 µm	cuneiform, 5-6 x 3.5-5.0 µm

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Wang, C. J. K. 1990. Ultrastructure of percurrent proliferating conidiogenous cells and classification. *Stud. Mycol.* **32:** 49-64.

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A NEW SPECIES OF PERROTIA FROM TAIWAN

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ABSRACT

Perrotia nanjenshana, a new hyaloscyphaceaous fungus is described from Taiwan. Its wide, 3-septate spores with apical spine-like appendages and lack of a pore plug in the ascus make it distinctive in that family. A specimen from Java was also located.

KEY WORDS: Hyaloscyphaceae, *Perrotia,* Taiwan, Java

INTRODUCTION: While the first author was investigating the macrofungal flora of Nanjenshan forest in southern Taiwan, a small hairy discomycete was repeatedly encountered. It is characterized by having nonamyloid asci with no trace of a pore plug and three-septate spores with fine, spine-like appendages at each end. These first two characters fit the concept of *Perrotia* Boud. (Dennis 1981, Spooner 1987), while the spore characters make it very distinctive among inoperculate discomycetes. An additional specimen from Java was located among the Southeast Asian collections housed at CUP.

TAXONOMY

Perrotia nanjenshana Y. Z. Wang & J. H. Haines ***sp. nov***. (Figs. 1-6)
Apothecia 0.4-1.5 mm, erumpentia, sparsa, substipitata; disco flavido, concavo; excipulo albo, pilis obtusis, hyalinis, crasse tunicatis, scabrusculis, septatis, 61-110 x 2.5-3..2 μm, obtecto. Asci cylindracei, apice rotundati, octospori, 70-90 x 10-12 μm, apice jodo non tincti. Ascosporae distichae, rectae, ellipticae, hyalinae, 16-20 x 4.2 μm, septatae. Paraphyses filiformes, ad apicem 1.5 - 2.5 μm crassae.

Holotypus: *Taiwan, Pintung: Nanjenshan, 12.II.1997, WAN 388 (TNM); Isotype (NYS).*

Apothecia 0.4-1.2 mm diam., erumpent through breaks in bark, single or caespitose in clusters of up to 8, short stipitate. **Receptacle** cupulate, with regular, circular margin when young, becoming irregular and wavy when fully expanded and dry, densely clothed with bright, white hairs which partially obscure the disc in undeveloped specimens, smaller apothecia proliferating from the edge of the disc in some specimens. Disc yellowish, drying yellow-buff, sometimes appearing translucent when sectioned or broken, concave, exposed in fully expanded specimens even when dry. Stipe, stout, simple, short, up to 0.3 mm in diam., often obscured at the base by the substrate,

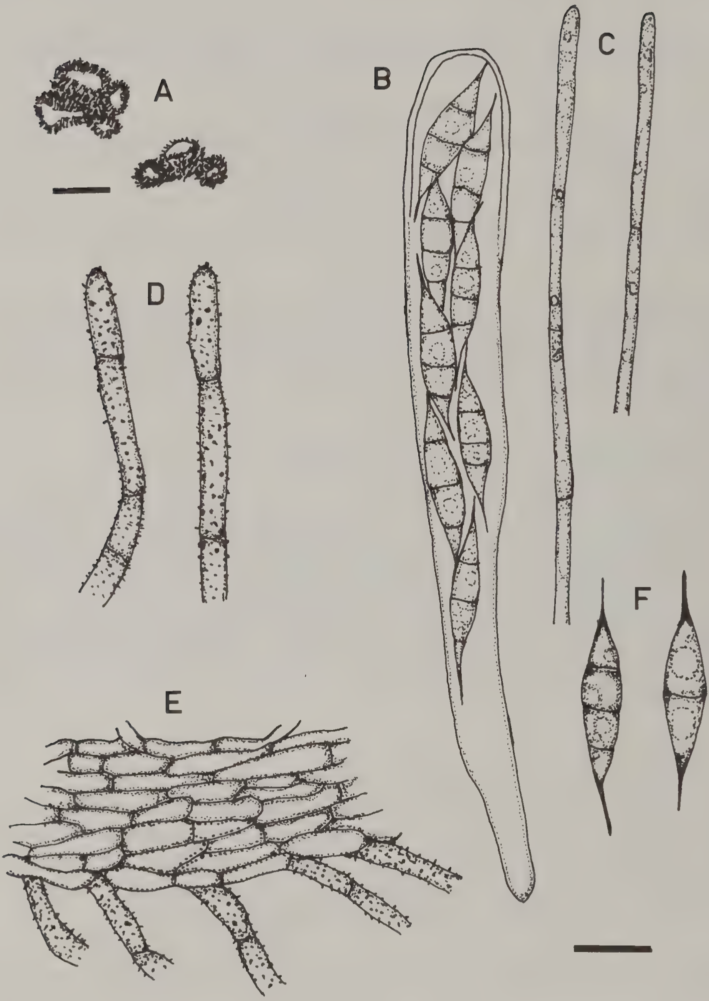
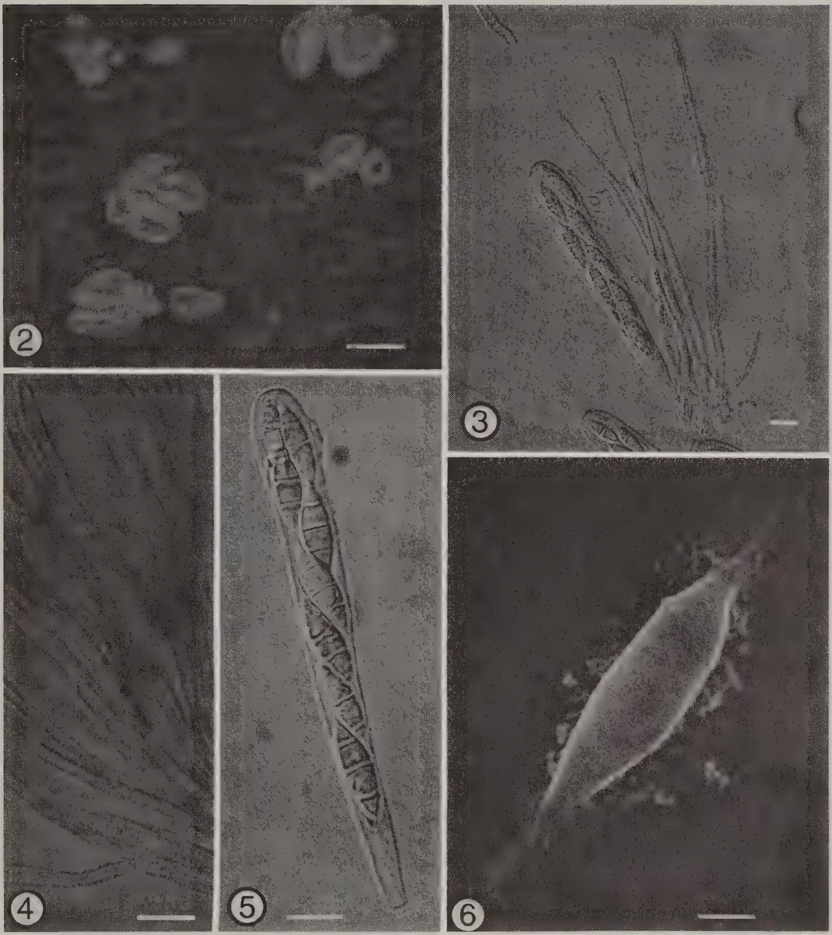


Fig. 1. *Perrotia nanjenshana* (Holotype). A. Apothecia. B. An ascus with ascospores. C. Paraphyses. D. Hairs. F. Ascospores. Bar = 1 mm for A, 10 µm for B,C,D,E, and F.



Figs. 2-6. *Perrotia nanjenshana* (Holotype). 2. Apothecia on substrate. 3. Ascus with paraphyses. 4. Hairs. 5. Ascus with ascospores. 6. Ascospore (SEM). Bars = 1 mm for 2, 10 μm for 3, 4, 5, and 5 μm for 6.

ochreous, sparsely clothed with white hairs. **Ectal excipulum** 25-100 μm thick, of irregular textura prismatica formed by hyaline, thin-walled cells, 8-22 x 2-3 μm, often curved or interwoven with each other. **Medulary excipulum** 60-80 μm thick, composed of textura intricata formed by thin-walled, hyaline hyphae, 1.5-2.5 μm in diam. **Hairs** up to 110 X 2.5-3.2 µm, flexuous and unevenly cylindrical, narrowing to a rounded apex, unbranched, 1- 3-septate, slightly thick-walled, walls 0.2-0.5 µm thick, hyaline, coarsely ornamented with hyaline, irregular granules up to 1 µm in diam.; hairs originating at a low angle from the ends of surface cells of the ectal excipulum. **Asci** 70-90(-112) X 8-12 µm, 8-spored, cylindric-clavate, slightly narrowing to a hemispherical apex; tapered toward the base, basal septum ca. 2.5 µm across, without a crozier. Outer ascus wall thin, even at the apex, with no indication of an apical pore. Cell membrane separated from the cell wall by a wide space. At the apex the membrane forms a dimple which widens as the ascus matures into a broad, flat-topped knob. The tip of the ascus is unchanged in Melzer's solution. **Ascospores** 16-20 X 4.2-5.2 µm not including appendages, broadly fusiform, straight, slightly wider in the apical half, with a distinct, narrow appendage, 0.3-0.5 µm wide and up to 8 µm long at each end, hyaline, usually 3-septate, without conspicuous inclusions. **Paraphyses** cylindrical throughout with obtuse apices, 1.5-2.0 µm wide, exceeding mature asci by up to 10 µm, regularly septate forming cells 12-20 µm long, straight, unbranched, with light yellow inclusions.

Holotype: Taiwan, Pintung: Nanjenshan, alt. 300 m, on dead branches of broad-leaved tree, 12.II.1997, coll. C. C. Wen, WAN 388 (TNM); Isotype (NYS).

Etymology: Latinized from Nanjenshan; locality of the type collection.

Habitat: Saprophytic, on dead branches of broad-leaved trees.

Additional specimens examined: TAIWAN, Pintung: Nanjenshan, coll C. C. Wen, 11.III.1997, WAN 392 (TNM); 21.V.1997 WAN 434 (TNM); 12.IV.1998 WAN 581 (TNM); INDONESIA, Java, Tjibodas, Along trail up Mt. Gedeh, on small woody twig, coll. K. P. Dumont & Wiriwan, 4.I.1967, CUP-SA 2995 (CUP).

This distinctive hyaloscyphaceous species differs from all other discomycetes by having 3-septate spores with a conspicuous, tapered appendages at each end. It is placed in the genus *Perrotia* because it has a thin-walled ascus which lacks an apical pore (Spooner, 1987). *Perrotia apiculata* (Dennis) Spooner also has apiculate ascospores, but which are aseptate, and the apiculi are not prominent. It differs from *Perrotia flammea,* the type of the genus, in having hyaline, thin-walled hairs with fine incrustations and an ectal excipulum of textura prismatica. The disjunct geographic localities of the known collections is likely due to the scarcity of mycologist to explore the vast tropical regions. The systematic exploration of Taiwan will undoubtedly reveal many new species of fungi for the region.

ACKNOWLEDGEMENTS

The authors thank Mr. C. C. Wen for collecting specimens, Mr. W. N. Chou for the Latin description, and Dr. Sharon A. Cantrell for reviewing the paper.

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NEW AND RARE SPECIES OF HETEROBASIDIOMYCETES

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ABSTRACT

Six new species of heterobasidiomycetes are described, one from Russia, *Achroomyces sibiricus*, and five from Denmark: *Achroomyces soranus*, *Spiculogloea subminuta*, *Tremella caloceraticola*, *T. colpomaticola* and *T. silvae-dravedae*. A new name, *Tremella karstenii*, is proposed to replace the illegitimate *Tremella juniperina* P. Karst. *Platygloea laplata* and *Tremella indecorata* are illustrated and compared to some of the new species. *Endoperplexa enodulosa* is illustrated from a recent collection with a conidial state connected to the basidial state. The zygoconidia of *Syzygospora pallida* are shown to germinate directly with a clamp-connection and a haustorium. Finally, the first Danish record of the rare *Exidiopsis gloeophora* is reported and illustrated.

INTRODUCTION

In a series of papers a number of new resupinate basidiomycetes have been described, mainly from Denmark (Hauerslev 1993). In the present paper some new species are described and others are illustrated for comparison or because few illustrations of them exist.

The specimens were studied using light microscopy incl. phase-contrast. Dried material was cut with a razor-blade and transferred to a drop of 3 % KOH or ammonia. For staining a number of reagents were used incl. phloxine, congo red, cotton blue, rhodamine and Melzer´s solution. The drawings were made with a camera lucida. All the cited material is deposited in Copenhagen (C) unless otherwise stated.

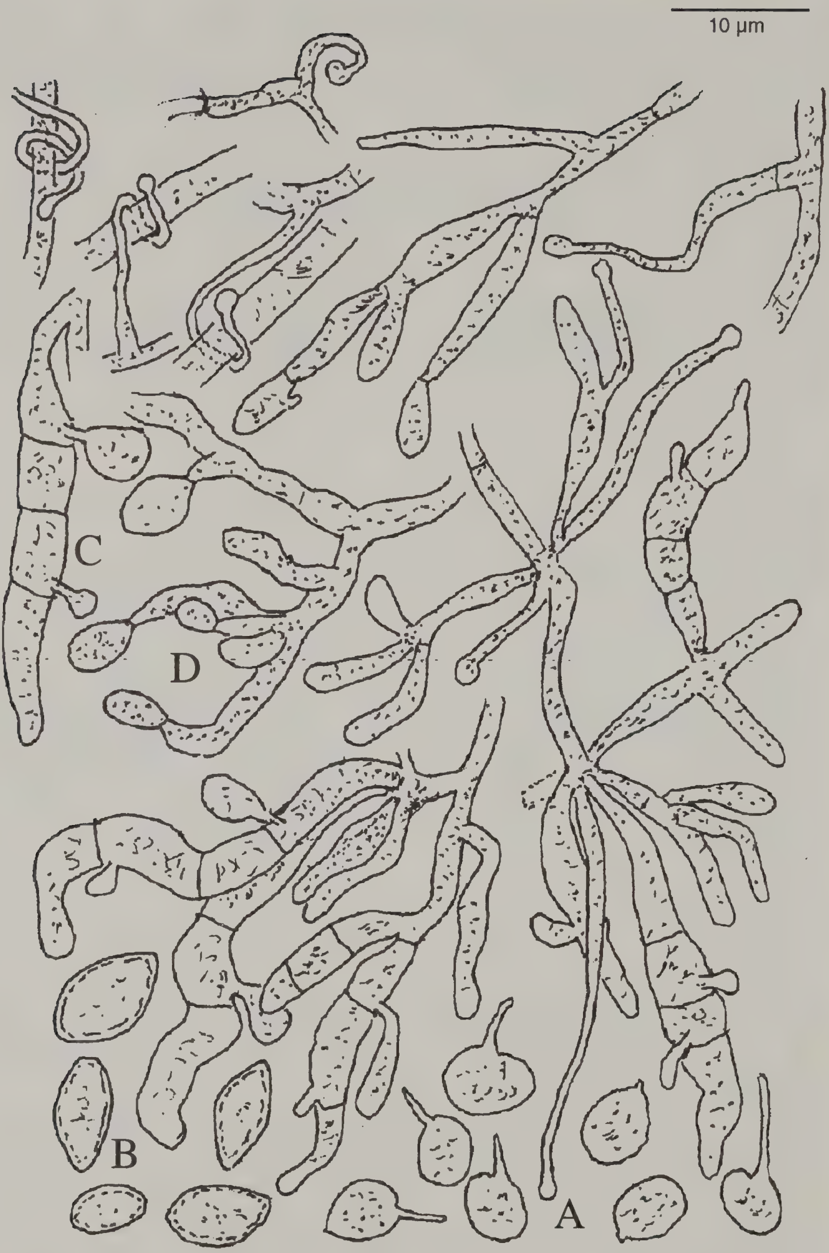

Fig. 1. *Achroomyces soranus* Hauerslev sp. nov. A: Spores; B: Conidia; C: Basidium; D: Conidiophore.K. Hauerslev no. 5634.

Achroomyces soranus Hauerslev sp. nov. Fig. 1

In fructificationibus Dacryomycetis stillati parasiticus.
Hyphae hyalinae, tenuiter tunicatae, 1-2(-3) µm latae, sine fibulis. Haustoria adsunt. Basidia cylindracea (15-)20-35 x (3-)4-5 µm, transverse septata, 3-4-cellularia, sterigmatibus plerumque brevibus ornata. Sporae ovoideae, (4.5-)5-6.5 x 4-5 µm, minute apiculatae. Conidia amygdali-fusiformia, crassitunicata, 6-10 x 3-6 µm

Holotype: Denmark, Zealand, Sorø Akademi Park, 1.VI.1962, in *Dacryomyces stillatus* Nees on *Tilia* (?), leg. K. Hauerslev no. 5634 (C).

Fruitbody growing in *Dacryomyces stillatus*. Hyphae hyaline, thin-walled, 1-2(-3) µm broad, without clamp-connections. Haustoria thin, hyphae-like with capitate apex, coiling around hyphae of the host. Basidia erect to flexuous, cylindric, transversely septate, (3-)4-celled, (15-)20-35 x (3-)4-5 µm, with mostly short sterigmata. Spores ovoid, (4.5-)5-6.5 x 4-5 µm, with small apiculus, forming secondary spores. Conidiophores branched. Conidia ellipsoid to fusoid, thick-walled, 6-10 x 3-6 µm.

Note: Close to *Achroomyces arrhytidiae* (L.S. Olive) Wojewoda, but *A. soranus* has smaller spores, thick-walled, larger conidia and haustoria.

Achroomyces sibiricus Hauerslev sp. nov. Fig. 2-3

Fructificatio resupinata, pallide cremea, margine leviter fimbriata.
Hyphae hyalinae, cylindraceae vel irregulares, tenuiter tunicatae, nodosae vel enodosae, 2.5-7(-8.5) µm. Basidia cylindracea, transverse septata, 84-112(-120 ?) x 8-13 µm, cellulis 4. Sporae hyalinae, tenuiter tunicatae, subglobosae vel ellipsoideae, 12-21(-22) x 9-17(-18) µm, apiculatae, non-cyanophilae, non-amyloideae, per repetitionem germinantes.

Holotype: Russia, Magadanskyi oblast, Arman River N of Madeus, 17. VIII.1995, on *Chosenia arbutifolia* (Pall.) A. Skv., leg. P. Corfixen no. 95.175 (C).

Fruitbody resupinate, whitish-creamish, regularly effused, tomentose velvety. Margin thinning out.
Hyphae thin-walled or somewhat thick-walled, with or without clamp-connections at the septa, hyaline, irregular or cylindric, 2.5-7(-8.5) µm.

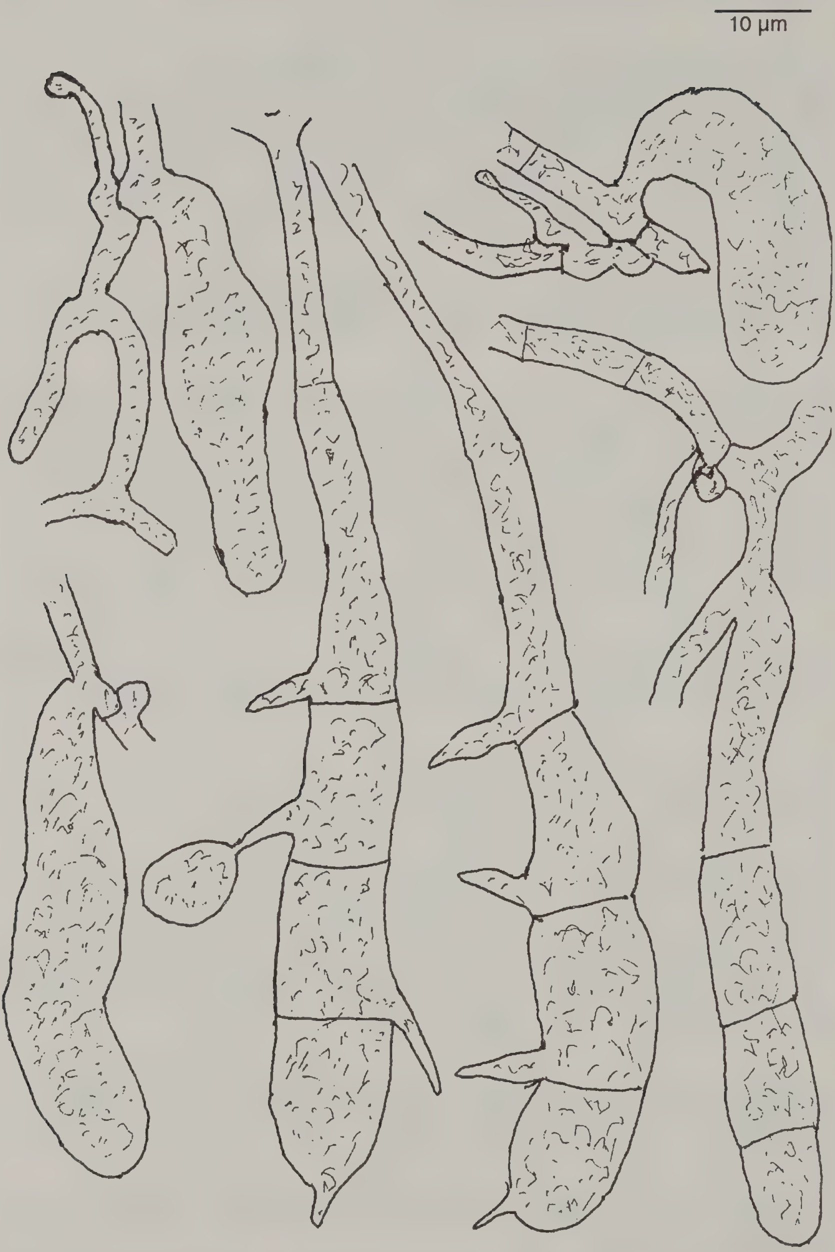

Fig. 2. *Achroomyces sibiricus* Hauerslev sp. nov. Basidia. P. Corfixen no. 95.175.

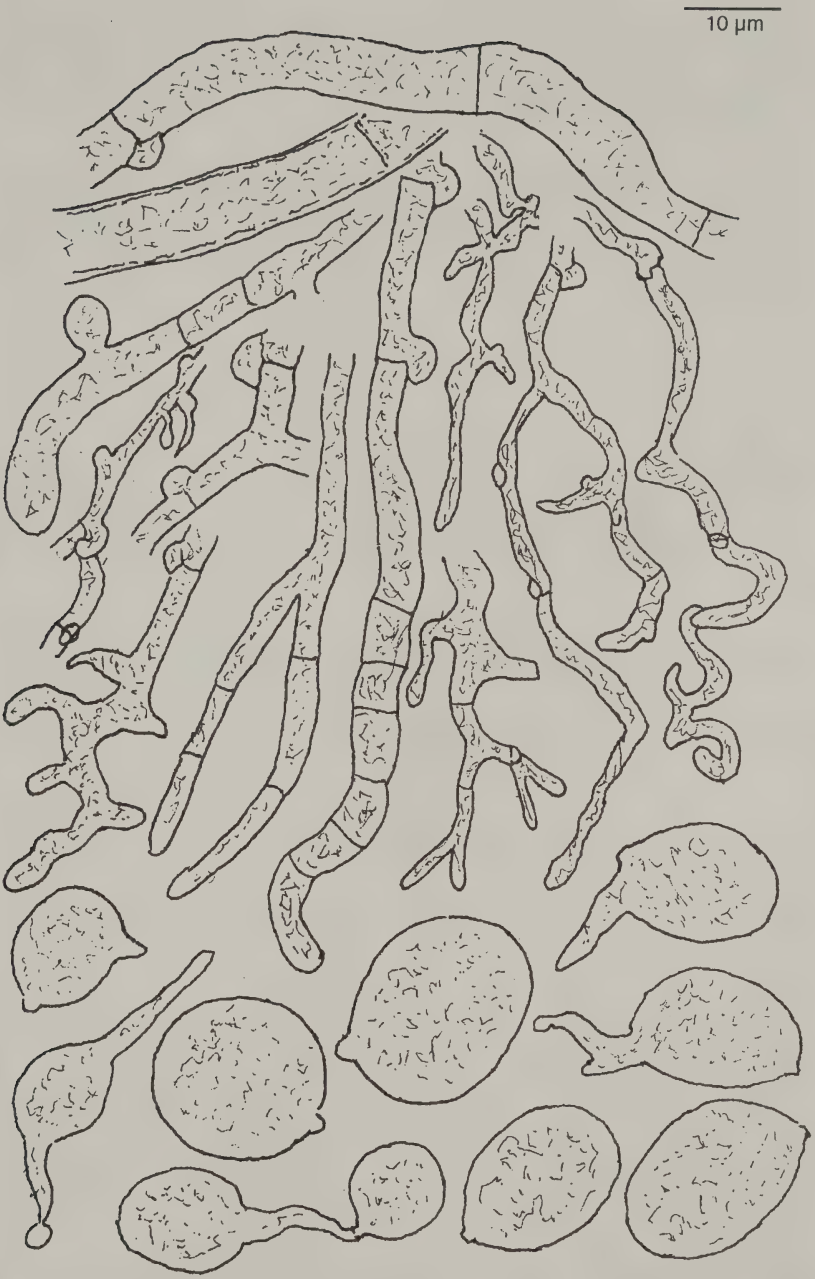

Fig. 3. *Achroomyces sibiricus* Hauerslev sp. nov. Spores, hyphae and hyphidia. P. Corfixen no. 95.175

Hyphidia irregular. Basidia cylindric, transversely septate, 84-112(-120 ?) x 8-13 µm, with four short sterigmata. Spores hyaline, smooth, subspherical to broadly ovoid, thin-walled, 12-21(-22) x 9-17(-18) µm, apiculate, non-cyanophilous, non-amyloid, forming secondary spores.

Note: *Achroomyces sibiricus* resembles *Platygloea laplata* Lindsey (below) but has larger spores, larger basidia and different hyphae. For comparison the type of *P. laplata* was examined and a short description and a drawing of it is included (Fig. 4).

Platygloea laplata Lindsey, Mycotaxon 27: 333, 1986. Fig. 4

Fruitbody whitish, smooth, farinaceous.
Hyphae thin-walled, with clamps, 3-4.5 µm broad. Hyphidia few. Basidia 4-celled, about 100 x 9 µm, with sterigmata to 15 x 3 µm. Spores ovoid, smooth, hyaline, 11-17 x 8-12 µm, non-amyloid, germinating by repetition or budding.

Isotype: USA, Colorado, Sheep Springs near boundary of San Juan, leg. N.F. Laplata, 29.IX.1984, J. Page Lindsey no. 1279 (BPI).

Note: See *Achroomyces sibiricus* above.

Endoperplexa enodulosa (Hauerslev) P. Roberts, Fig. 5
Mycol. Res. 97(4): 473, 1993.

Basionym: *Sebacina enodulosa* Hauerslev, Windahlia 16: 47, 1986.

Fruitbody effused, whitish, thin, mealy to arachnoid.
Hyphae hyaline, 1-3 µm broad, lower hyphae in parenchym up to 4.5 µm, long hyphae from hymenium 1-2.5 µm, somewhat coloured, giving rise to conidiophores. Conidia cylindric to fusoid, 0-1-septate, hyaline, 10-20 x 2.5-4 µm. Leptocystidia ovoid to clavate, thin-walled, hyaline, 14-20 x 5.5-8 µm. Basidia subglobose to ovoid, 6-8 x 6.5-7 µm, becoming 2-celled by longitudinal division. Spores ellipsoid to broadly cylindric, with small apiculus, 8.5-12 x 3.5-4.5 µm, non-amyloid, forming secondary spores.

Material: Denmark, Zealand, Langebæk Skov, 1.VII.1997, on *Tilia*, K. Hauerslev no. 7632.

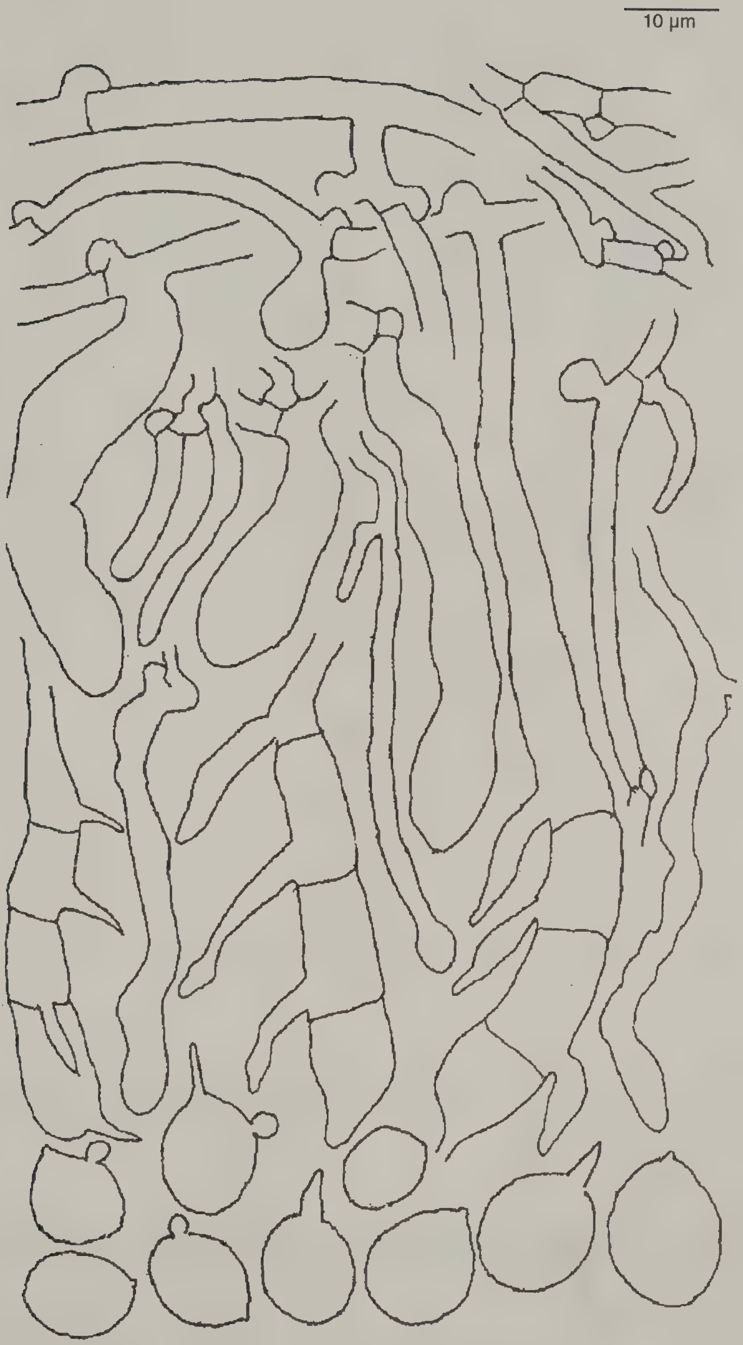

Fig.4. *Platygloea laplata* Lindsey. Lindsey no. 1279.

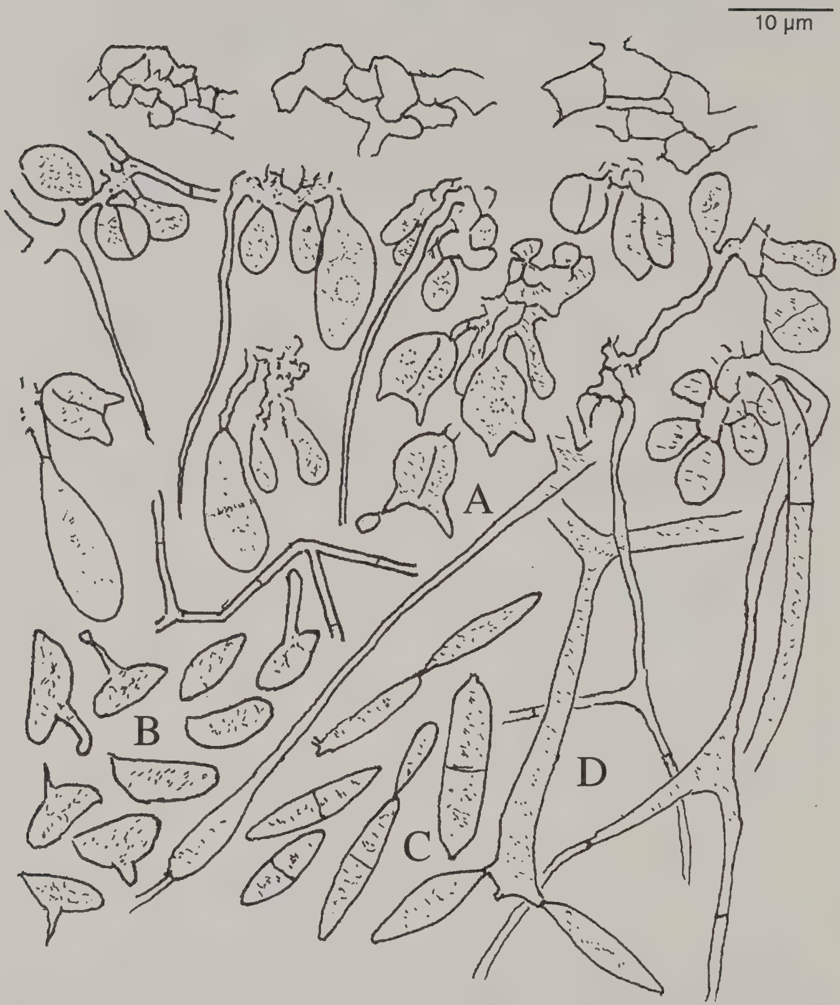

Fig. (5) *Endoperplexa enodulosa* (Hauerslev) P. Roberts. A: Basidia; B: spores; C: conidia; D: conidiophore. K. Hauerslev no. 7632.

Note: The conidia and the long thin hyphae were also found in the type of *S. enodulosa*, but at that time were not considered to belong to this fungus. Conidia were not found in *S. enodulosa* forma *tetraspora* Hauerslev (Hauerslev 1993).

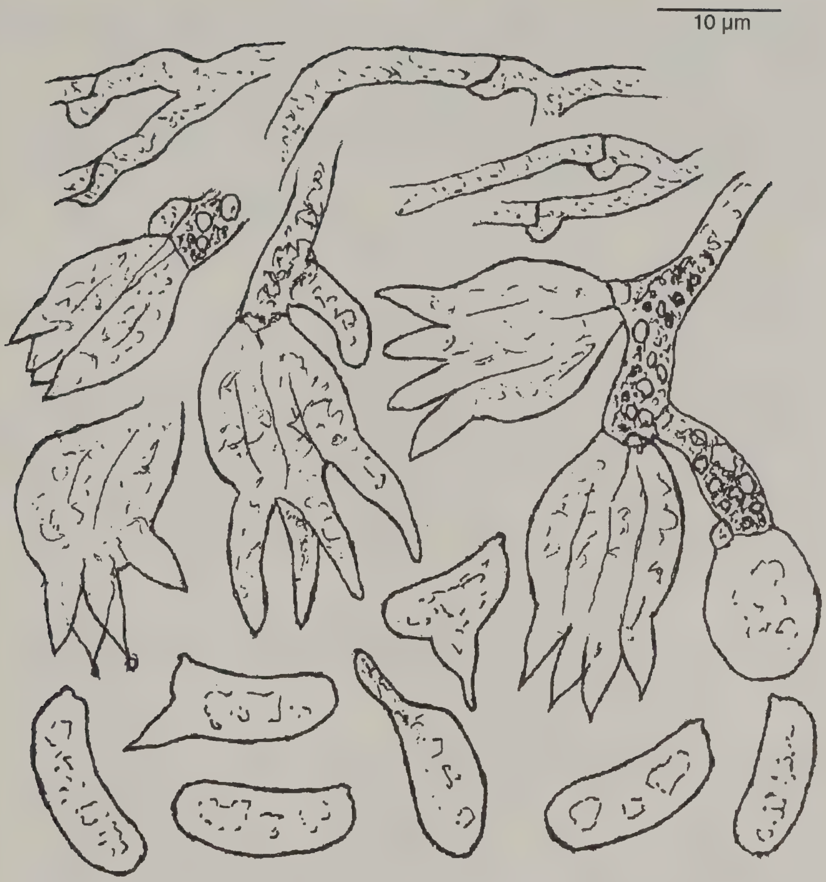

Fig. 6. *Exidiopsis gloeophora* (Oberw.) Wojewoda. K. Hauerslev no. 6800, 6801.

Exidiopsis gloeophora (Oberw.) Wojewoda, Fig. (6)
Flora Polska, Grzyby 8: 111, 1977.
Basionym: *Sebacina gloeophora* Oberw., Nova Hedwigia 7: 495, 1964.

A short description and a drawing is provided from the first Danish record of this rare species, otherwise only known from Germany (Oberwinkler 1964).

Fruitbody very thin, just visible.
Hyphae thin-walled, 2-3 µm broad, with clamp-connections, subbasidial

hyphae with oily drops. Basidia longitudinally divided, about 14-15 x 10-13 µm, with short sterigmata. Spores curved-cylindric, 13-15 x 5-6 µm, forming secondary spores.

Material: Denmark, Zealand, Allerød, Ravnsholt Skov, 25.X.1987, on wood, leg. K. Hauerslev no. 6800, 6801.

Spiculogloea subminuta Hauerslev sp. nov. Fig. 7

Fungus in *Botryobasidio subcoronato* parasiticus.
Hyphae hyalinae, tenuiter tunicatae, 0.5-1.5 µm in diam. noduloso-septatae. Haustoria adsunt. Basidia cylindracea, minute aspera, transverso-septata, 30-65 x 3-4 µm, basi angustiori. Sporae subcylindraceae, apiculatae, 8.5-10(-13) x 2-3 µm, non-amyloideae, per repetitionem germinantes. Conidia fibulas basilares praebentia, ellipsoidea, crassi-tunicata, 4.5-5 x 2.5-3 µm, cyanophila.

Holotype: Denmark, Zealand, Hareskoven, 24.IX.1981, leg. K. Hauerslev no. 5987 (C), parasitic in *Botryobasidium subcoronatum* (Höhn. & Litsch.) Donk.

Parasitic in *Botryobasidium subcoronatum* (Höhn. & Litsch.) Donk.
Hyphae hyaline, thin-walled, 0.5-1.5 µm broad, with clamp-connections. Haustoria present. Basidia thin-walled, smooth or often asperulate, not cyanophilous, 30-65 x 3-4 µm, transversely septate, 4-celled, with long or short narrower base. Spores subcylindric, 8.5-10(-13) x 2-3 µm, hyaline, thin-walled, apiculate, smooth, non-amyloid, forming secondary spores. Conidiophores forming conidia, 4.5-5 x 2.5-3 µm, subtended by a clamp-connection, cyanophilous.

Other material: Denmark, Zealand, Hareskoven, 6.XI.1978, leg. K. Hauerslev no. 5791; idem, 2.VI.1980, ibidem no. 5878; idem, 2.VII.1981, ibidem no. 5960; idem, 2.VII.1981, ibidem no. 5963; idem, 24.IX.1981, ibidem no. 5991.

Holotype of *Spiculogloea minuta*: England, Devon, Great Plantation, Bovey Tracey, on *Tulasnella violea* on *Salix*, 29.VI.1991, leg. P.J. Roberts no. 271 (K).

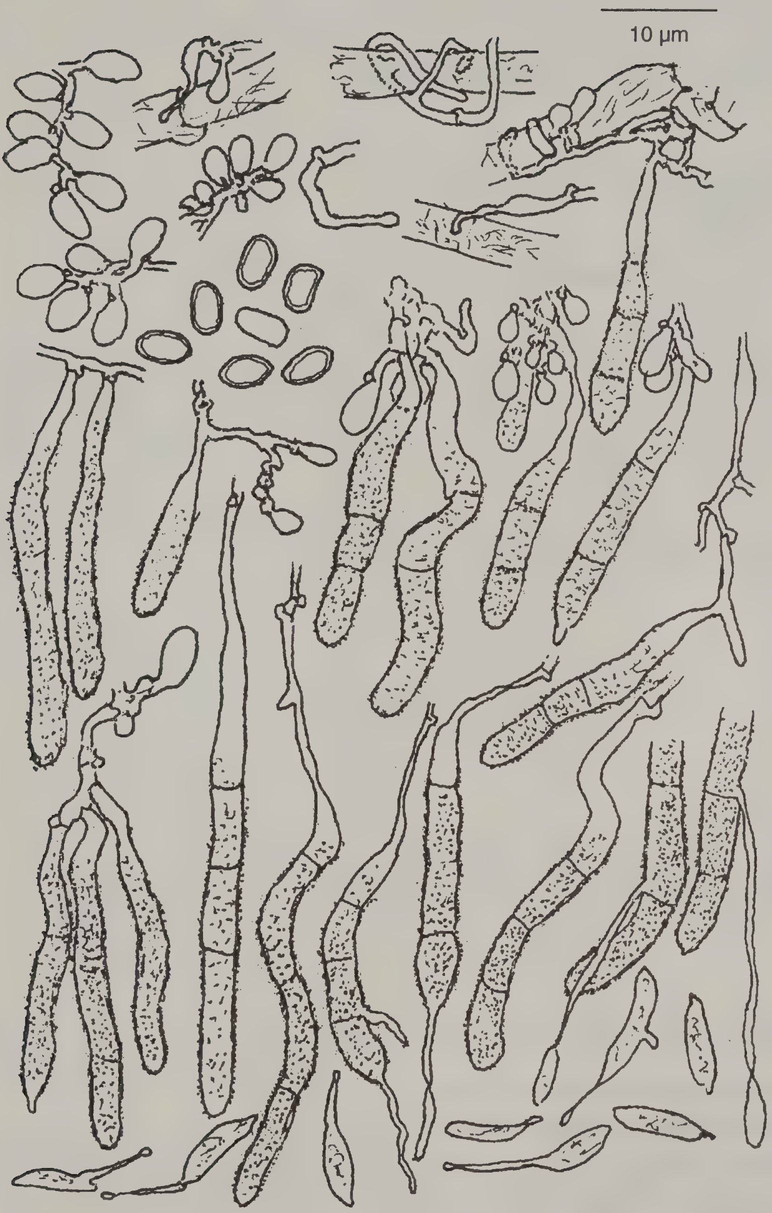

Fig. 7. *Spiculogloea subminuta* Hauerslev sp. nov. A: spores; B: conidia; C: haustoria. K. Hauerslev no. 5987

Note: Separated from *S. minuta* P. Roberts (Roberts 1997) by the longer basidia not arising in clusters, by the somewhat larger spores and by the presence of conidia. It may be host-specific.

Syzygospora pallida (Hauerslev) Ginns, Mycologia 78: 631, 1986. Fig. 8

Basionym: *Christiansenia pallida* Hauerslev, Friesia 9: 43, 1969.

A note should be added to the previous descriptions of this species by Hauerslev (loc. cit.) and Ginns (loc. cit.): in a recent collection, the zygoconidia were seen to germinate directly with a clamp-connection from which a haustorium developed, thus emphazising the importance of parasitism for this species.

Material: Denmark, Samsø, Mårup Skov, 23.V.1994, on *Phanerochaete sordida* on *Pinus*, leg. K. Hauerslev no. 7444.

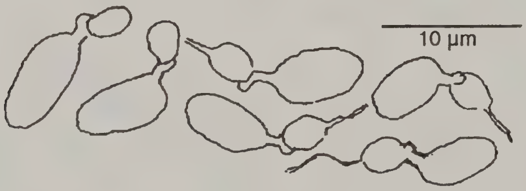

Fig. 8. *Syzygospora pallida* (Hauerslev) Ginns. Germinating zygoconidia with clamps and haustoria. K. Hauerslev no. 7444.

Tremella caloceraticola Hauerslev sp. nov. Fig. 9

Fungus in *Calocerate cornea* parasiticus.
Hyphae hyalinae, tenuiter tunicatae, 1-3 µm in diam., noduloso-septatae. Haustoria adsunt. Basidia globosa vel subglobosa, basi noduloso-septata, 5-7-9 µm in diam., longitudinaliter septata, 2 sterigmata usque ad 140 µm longa ferentia. Sporae subglobosae vel ovoideae 7-8 x 4.5-6 µm, tunicis tenuibus, laevibus obtectae, apiculatae, per repetitionem germinantes.

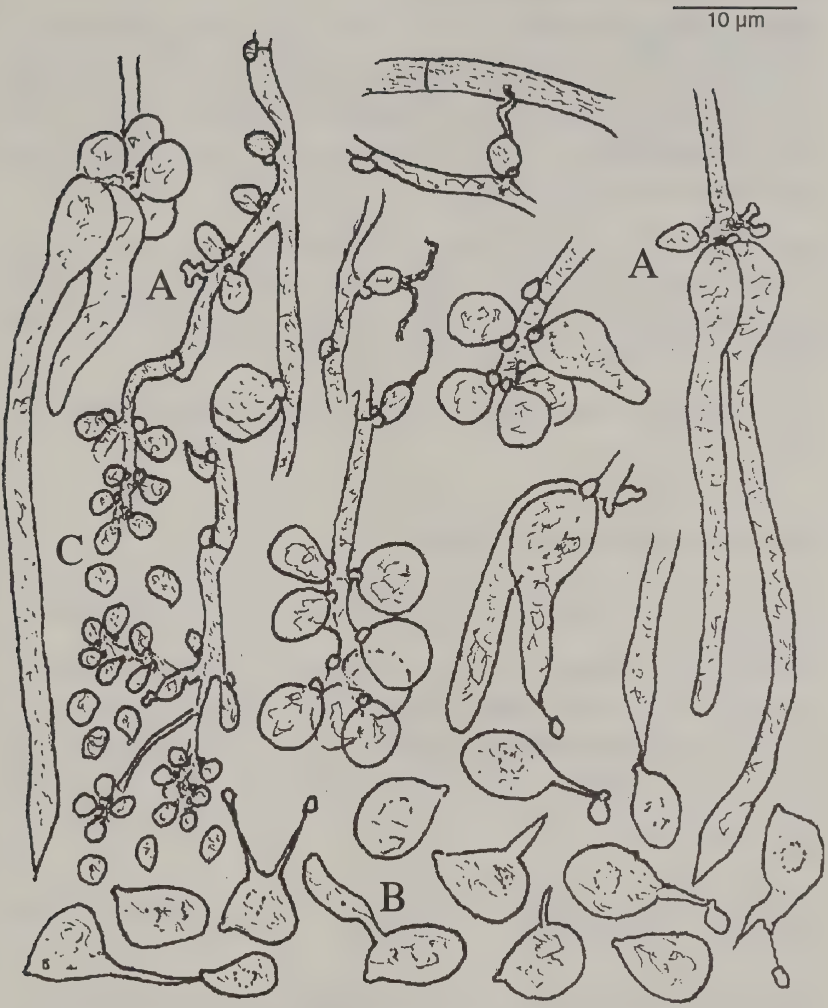

Fig. 9. *Tremella caloceraticola* Hauerslev sp. nov. A: Basidia; B: spores; C: conidia. K. Hauerslev no. 7464.

Conidiophora adsunt conidia subglobosa 3-4 x 3-3.5 µm ferentia.

Holotype: Denmark, Zealand, Jægersborg Dyrehave, 25.IX.1994, in *Calocera cornea* (Batsch : Fr.) Fr. on *Fagus silvatica*, leg. K. Hauerslev no. 7464 (C).

Fruitbody parasitic in *Calocera cornea*.
Hyphae hyaline, thin-walled, 1-3 µm broad, with clamp-connections and haustorial branches. Basidia subglobose to ovoid with basal clamp-connection, becoming 2-celled by longitudinal division, 5-7-9 µm broad. Sterigmata up to 140 µm long. Spores hyaline, thin-walled, subglobose to ovoid, 7-8 x 4.5-6 µm, apiculate and forming secondary spores. Conidiophores forming subglobose conidia 3-4 x 3-3.5 µm.

Other material: Denmark, Zealand, Hareskoven, 2.X.1991, leg. K. Hauerslev no. 7228; idem, 5.X.1991, ibidem no. 7234; idem, 6.X.1991, ibidem no. 7230; idem, 30.VIII.1992, ibidem no. 7280; idem, 28.X.1993, ibidem no. 7399; Jægersborg Dyrehave, 26.X.1994, ibidem no. 7484.

Note: The conidial state seems to be common, whereas basidia are difficult to find.

Tremella colpomaticola Hauerslev sp. nov. Fig. 10

Fungus in *Colpoma quercinum* parasiticus. Fructificatio gelatinosa, luteola, in siccitate brunnea.
Hyphae tenuiter tunicatae, 0.5-2.5 µm latae, enodes vel indistincte nodulosae. Haustoria adsunt. Basidia globosa vel ellipsoidea, ad 7-10 µm in diam. vel 12-22 x 6-8 µm, longitudinaliter vel oblique septata 2-sterigmatibus usque ad 40 µm longis ornata. Conidia ellipsoidea ad 1.5-2 x 2-2.5 µm. Sporae subglobosae vel ovoideae, 4-6 x 4-7 µm, hyalinae, apiculatae, per repetitionem germinantes.

Holotype: Denmark, Zealand, Geel Skov, on *Colpoma quercinum* (Pers.) Wallr., leg. B. Klug-Andersen, 7.V.1994 (C).

Fruitbody 2-3 mm, gelatinous, yellowish, drying brown. Hyphae thin-walled, 0.5-2.5 µm broad, if clamp-connections are lacking then often with a small knob near the septum, or with clamp-connections. Haustoria present. Basidia globose to ellipsoid, longitudinally or transversely septate, 2-spored, about 7-10 µm in diam. or 12-22 x 6-8 µm, single or clustered and sometimes in chains of 2-3 without basal clamp-connection or with an inconspicuous clamp-connection. Sterigmata up to 40 µm long. Conidia subglobose to ellipsoid, about 1.5-2 x 2-2.5 µm, from hyphae. Spores globose to ovoid, 4-6 x 4-7 µm, hyaline, smooth, apiculus blunt or truncate, forming secondary spores.

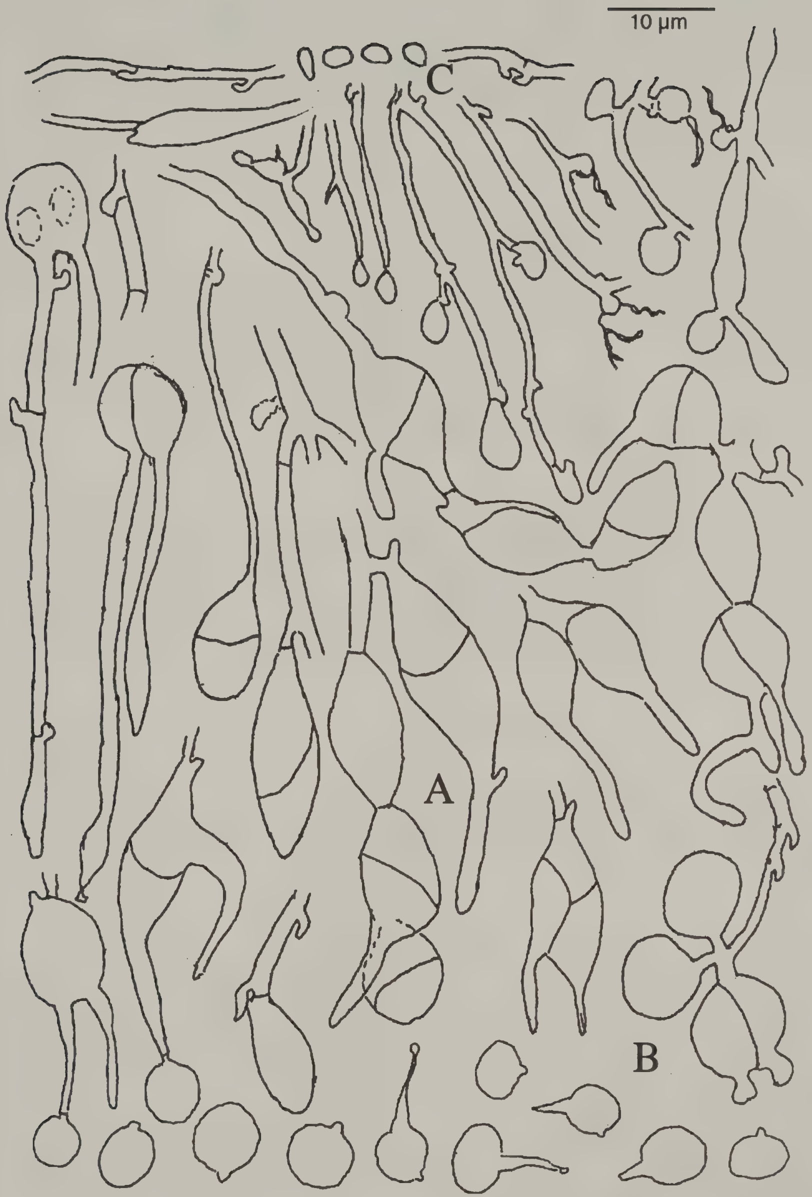

Fig. 10. Tremella colpomaticola Hauerslev sp. nov. A: Chain-forming-basidia; B: spores; C: conidia. B. Klug-Andersen, 7.V.1994.

Other material: Denmark, Zealand, Geel Skov, 15.IV.1994, leg. B. Klug-Andersen no. 94011; idem, 26.V.1994, ibidem no. 94083; idem, 9.IX.1994, ibidem; idem, 5.XII.1994, ibidem (K. Hauerslev no. 7484); idem, 6.II.1995, ibidem; idem, 7.3.1995, ibidem; Kongelunden near Copenhagen, 6.V.1994, leg. B.T. Olsen no. 94-005; Holte c. 17 km N of Copenhagen, 4.XI.1994, leg. K. Hauerslev no. 7480.

Tremella indecorata Sommerf., Fig. 11
Suppl. Fl. Lapponicae p. 306, 1826.
Parasitic on pyrenomycetes, mostly *Diatrype disciformis* (Hoffm. : Fr.) Fr.
Fruitbody gelatinous, hyaline, drying brown to dark brown, 1-3 mm.
Hyphae hyaline, 1-5 µm broad, with clamp-connections. Haustoria present. Basidia globose to subglobose, sometimes oblong, about 10-22 µm, 2-4-sterigmate. Spores subglobose, hyaline, smooth, 6-12 x 7-11 µm, forming secondary spores.

Material, on *Diatrype disciformis*: Denmark, Zealand, Brorfelde, 2.V.1973, leg. M.D. Paulsen; Ganløse Egede, 15.V.1973, leg. M.D. Paulsen; Sorø Sønderskov, 17.IX. 1973, leg. M.D. Paulsen; Geel Skov, 29.IX.1973, leg. M.D. Paulsen; Hareskoven, 29.IX.1973, leg. M.D. Paulsen; Slagelse Lystskov, 15.X.1973, leg. M.D. Paulsen; Vallø Storskov, 12.IV.1974, leg. M.D. Paulsen.

Tremella karstenii Hauerslev nom. nov. Fig. 12-13
Tremella juniperina P. Karst., Fung. Fenn. 1869 :exs. 812 non L.,Fl.Suec. 1755: 428; *Exidia juniperina* (P. Karst.) P. Karst., Krit.öfr. finl. Basidsv. 1889:452.

Parasitic in *Colpoma juniperi* (P. Karst.) Dennis.
Fruitbody gelatinous, 1-2.5 mm in diam., hyaline, drying yellowish. Hyphae thin-walled, some lower hyphae moderately thick-walled, 1-3.5 µm broad, provided with clamps. Haustorial cells subtended by a clamp. Basidia globose to ovoid, thin-walled, 2-4-celled, 9-12(-14) x 6.5-11 µm. Sterigmata thin, to 45 µm long. Spores globose to subglobose, 4-6 x 3.5-6 µm, with small apiculus, forming secondary spores. Conidiophores forming subglobose conidia, subtended by a clamp-connection or not, 3.5-6 µm, somewhat thick-walled and somewhat cyanophilous.

Lectotype: Finland, Tavastia Australis, Tammela, Mustiala, 8.IV.1869, leg. P. Karsten, Fungi Fenniae exs. no. 812 (H); idem, ibidem no. 1538

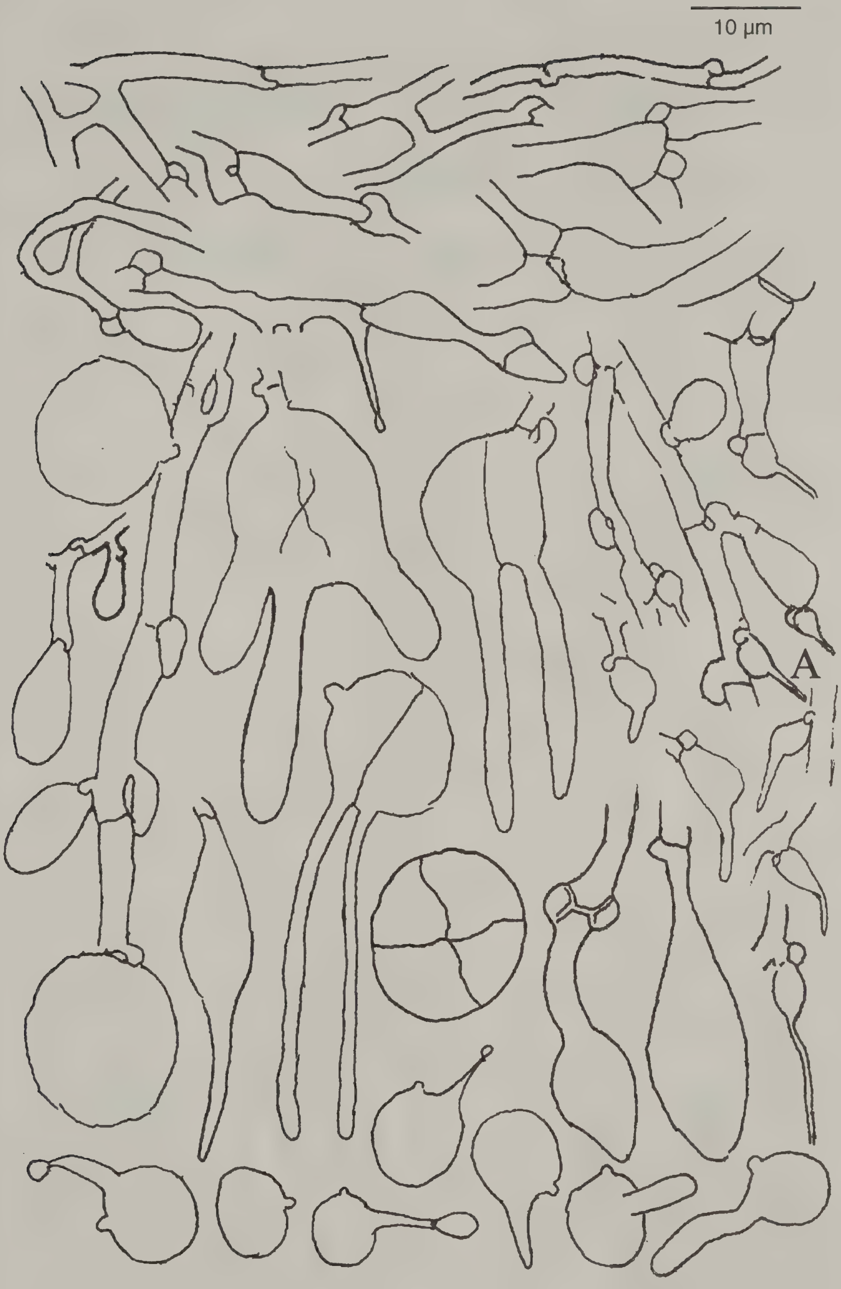

Fig. 11. *Tremella indecorata* Sommerf. A: Haustoria. M.D. Paulsen, 12 IV 1974.

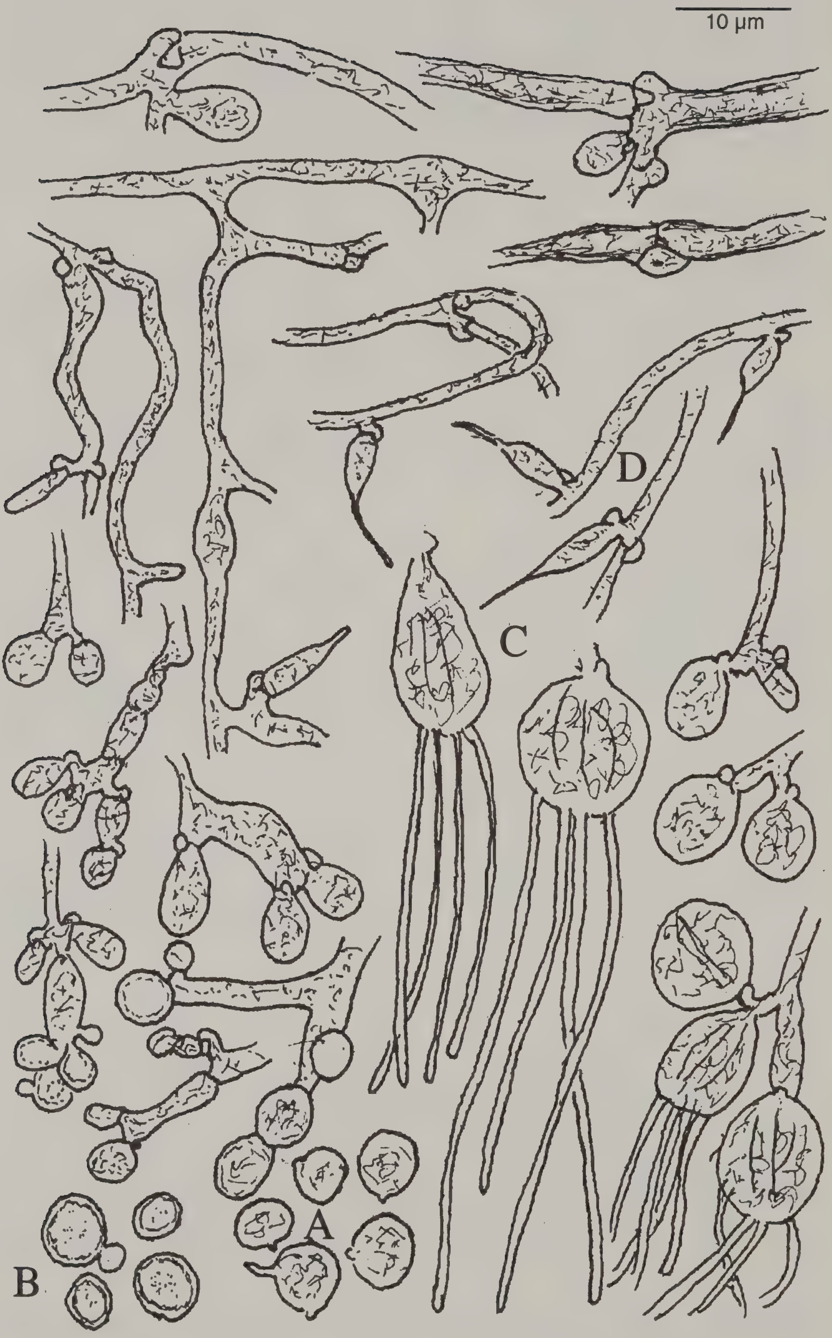

Fig. 12. *Tremella karstenii* Hauerslev nom. nov. L. & K. Holm. 16 VIII. 1967 A:Spores; B: Conidia; C: Basidia; D: Haustoria.

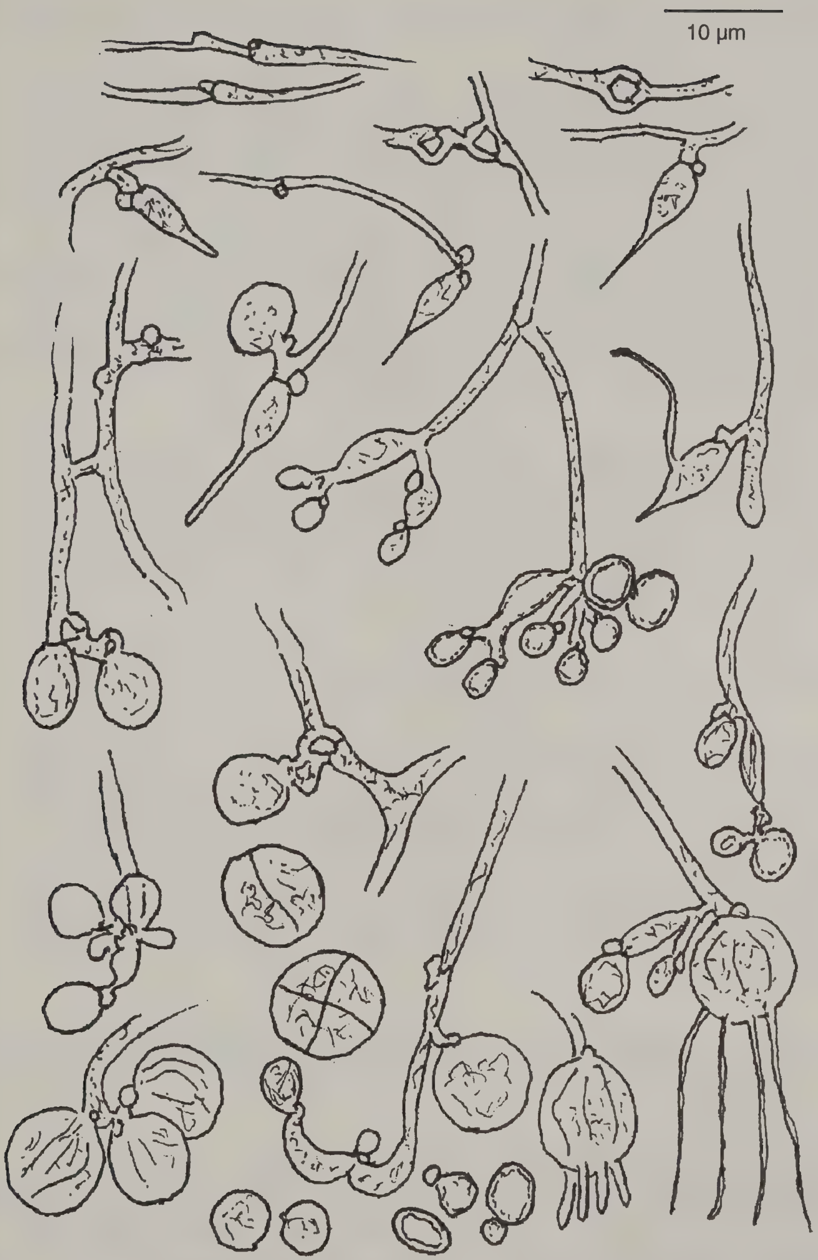

Fig. 13. *Tremella karstenii* Hauerslev nom. nov. P. Karsten No. 1538. Compare fig. 12.

(H, isolectotype); idem, ibidem, no. 1539 (H, isolectotype); idem, ibidem, no. 1814 (H, isolectotype).

Other material, all in UPS: Finland: Karelia, Vehkalahti, Pyhältö, Ämmänmäki, 4.VII.1977, leg. L. Fagerström. Sweden: Tännäs parish, S slope of the mount Hamrefjället, 16.VIII.1967, leg. L. & K. Holm; Lycksele Lappmark, Tärna socken, Umfors, 600 m a.s.l., 10.IX.1961, leg. L. Holm; Jämtland, Åre parish, S slope of the mount Mullfjället, 26.VIII.1967, leg. K. & L. Holm; Dalarne, St. Kopparberg parish, c. 6 km E of Falun, near the road to Svärdsjö and Sundborg, 21.XII.1967, leg. K. & L. Holm; Västermanland, Västerfärnebo parish, between the N part of the lake Stensjön and road no. 70, 6.IV.1973, leg. K. & L. Holm; Upland, Alsike parish, c. 100 m E of Morgastugan, 17.XI.1974, leg. K. & L. Holm.

Note: Torkelsen (1978) treated the substrate and the distribution of this parasite in Fennoscandia. It is described and figured here for comparison with *Tremella colpomaticola*, which grows on another species of *Colpoma*. The new name is necessary because of the older homonym *Tremella juniperina* L. (= *Gymnosporangium*).

Tremella silvae-dravedae Hauerslev sp. nov. Fig. 14

Fructificatio tenuis, gelatinosa, effusa, brunneo-lutea.
Hyphae hyalinae, tenuiter tunicatae, 1-2.5(-3) µm latae, noduloso-septatae. Basidia subglobosa vel ovoidea, longitudinaliter septata, 7-11 x 5-6.5 µm, basi noduloso-septata, 2-4-sterigmata ferentia. Gloeocystidia clavata vel flexuosa, intus materia flavida repleta, usque ad 30 x 4-6 µm. Sporae globosae, tenuiter tunicatae, hyalinae, minute apiculatae, 3.5-4.5 µm, non-amyloideae. Conidia bilobata, numerosa, transversim c. 3 µm, cyanophila, non-amyloidea.

Holotypus: Denmark, S-Jutland, Draved Skov, 18.VIII.1966, on *Tilia*, but fungal host unknown, K. Hauerslev no. 3417 (C).

Fruitbody thin, gelatinous, resupinate, dark yellow.
Hyphae hyaline, thin-walled, 1-2.5(-3) µm broad, with clamp-connections. Basidia subglobose to ovoid, becoming 2-4-celled, 7-11 x 5-6.5 µm, with basal clamp-connection. Gloeocystidia with brownish contents, more or less clavate to sinuous, up to 30 x 4-6 µm. Spores globose, thin-walled,

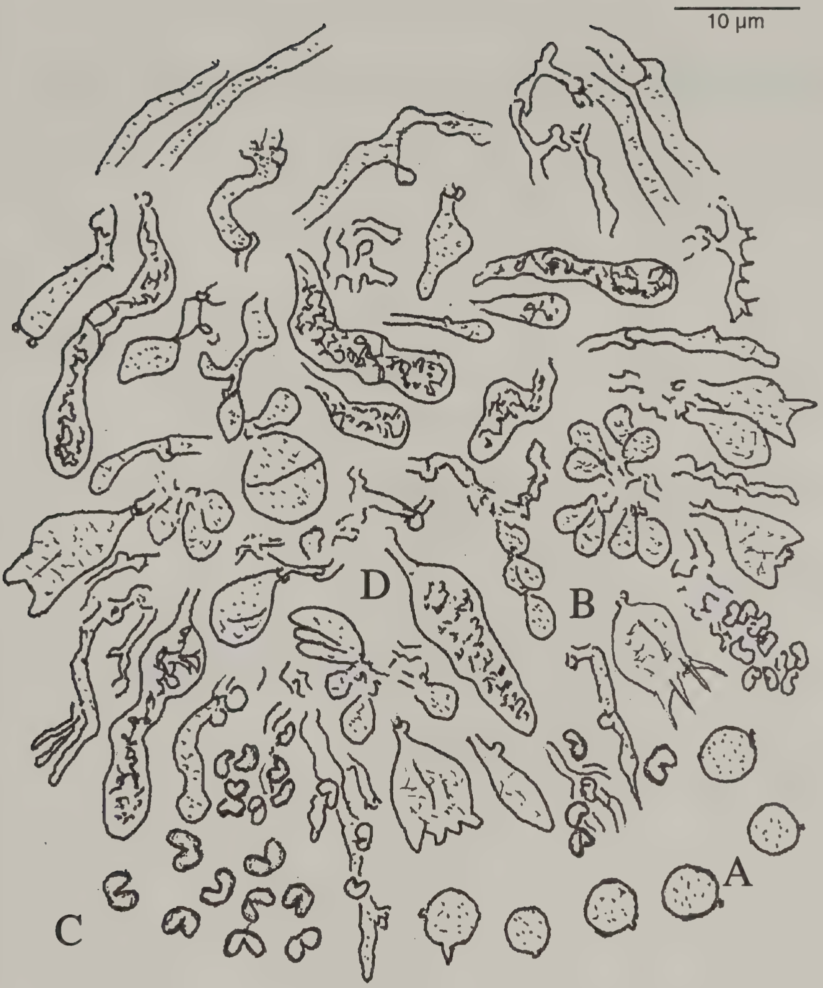

Fig. 14. *Tremella silvae-dravedae* Hauerslev sp. nov. A: Spores; B: Basidium; C: Conidia; D: Gloeocystidium. K. Hauerslev no. 3417

hyaline, with small apiculus, 3.5-4.5 µm. Conidia numerous, two-lobed, c. 3 µm across, cyanophilous.

Note: The species is remarkable for its two-lobed conidia.

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Franz Oberwinkler (Tübingen) and Peter Roberts (Kew) reviewed the paper, Henning Knudsen (Copenhagen) assisted in various ways, Peter Wagner (Copenhagen) checked the Latin diagnoses and the curators of Beltsville (BPI), Kew (K), Helsinki (H) and Uppsala (UPS) sent material on loan. Their cooperation is greatly appreciated.

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ANNOTATED CHECK-LIST OF THE GREEK MACROFUNGI. II. ASCOMYCOTINA

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Abstract. Second part of the preliminary checklist of Greek macrofungi covers Ascomycota, 185 species and infraspecific taxa (in 102 genera) of Discomycetes, Pyrenomycetes and Loculoascomycetes, forming macroscopic stromatal structures. Thirteen taxa are reported for the first time in Greece.

Key words. Macrofungi, Ascomycotina, Greece, *Lachnum soppittii* comb. nov.

The list of ascomycetous macrofungi, Discomycetes, Pyrenomycetes and Loculoascomycetes, forming macroscopic stromatal structures, is based on published data supplemented by recent collections by the authors. It covers data on 185 species and infraspecific taxa, members of 102 genera. Fourteen species are reported for the first time in Greece: *Hymenoscyphus scutula*, *H. virgultorum*, *Phialina pseudotuberula*, *Leotia lubrica*, *Geopyxis carbonaria*, *Helvella ephippium*, *H. queletii*, *Humaria hemisphaerica*, *Lachnum soppittii*, *Peziza michelii*, *P. violacea*, *Plicaria trachycarpa*, *Ramsbottomia asperior* and *Sarcosphaera crassa*.

This checklist is a part of a nation-wide study on the diversity of specific groups of microorganisms in selected ecosystems (Zervakis, 1999, Zervakis & al. 1999). For details on the research on biodiversity of fungi in Greece and methods used see our first paper dealing with Basidiomycotina (Zervakis & al., 1998).

Nomenclature follows Cannon & al. (1985), Dennis (1978) and Lizoň & Bacigálová (1998) and the genera are arranged in orders according to the last edition of the

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Dictionary of fungi (Hawksworth & al., 1995) with the exception of a new delimitation of Leotiales and Helotiales (Lizoň & al., 1998).

Each provides accepted name (some includes the name of a synonym or synonyms under which the taxon was reported), brief geographical information, data on host/substrate, and source of record. Recent collections by the authors have more detailed data.

Voucher specimens are held in the Plant Pathology Herbarium, Cornell University, Ithaca, USA (CUP), in the Herbarium of the Laboratory of General and Agricultural Microbiology, Agricultural University of Athens, Greece, (AUA-LGAM), and in the Herbarium of the Institute of Kalamata, National Agricultural Research Foundation, Greece, (NAGREF-IK). Maire and Politis' records (Maire & Politis, 1940) should be backed by specimens held in the Institute of Botany, Montpelier, France (MPU) and in the University of Athens, Greece (ATHUM), respectively. Almost all Petrak's specimens are housed in the Natural History Museum, Wien, Austria (W). Abbreviations used: Mt. = mountain, NPR = National park reserve, PF = Protected forest.

Arthoniales

Arthonia clemens (Tul.) Th. Fr.
Syn. *Conida clemens* (Tul.) Massal.
Mt. Kalidromon (Fthiotida): on *Lecanora agadhiana* (Maire & Politis, 1940).

Arthonia glaucomaria (Nyl.) Nyl.
Syn. *Celidium varians* (Dav.) Arnolds
Mt. Oiti (Fthiotida): on *Lecanora sordida* (Maire & Politis, 1940).

Arthonia intexta Almq.
Syn. *Celidium varians* var. *intexta* (Almq.) Rehm
Mt. Penteli (Attiki): on *Lecanora sordida, L. sulphurata* (Maire & Politis, 1940).

Conida nideri Steiner
Mt. Panaitolikon (Aitoloakarnania), and Mt. Kalidromon (Fthiotida): on *Caloplaca variabilis, C.* cf. *agardhiana* (Maire & Politis, 1940).

Conida lecanorina var. *aucta* Steiner
Mt. Kalidromon (Fthiotida): on *Caloplaca cinereovinosa* (Maire & Politis, 1940).
Note: This is probably *Arthonia clemens* (Tul.) Th. Fr.

Clavicipitales

Claviceps purpurea (Fr.) Tul.
Moutsoura (Epiros): on *Agropyrum intermedium* var. *villosum,* Krania (Larissa): on *Dactylis glomerata,* Mt. Chelmos (Achaia): on *Sesleria nitida,* Mt. Parnassos: on *Lolium perenne* (Maire & Politis, 1940); on *Secale cereale* (Sarejanni & al., 1952).

Epichloë typhina (Pers.) Tul.
Romvo Monastery (Aitoloakarnania): on *Secale montanum* (Maire & Politis, 1940); Thessaloniki: on *Dactylis* sp. and on *Poa* sp. (Sarejanni & Demetriades, 1951); on *Dactylis glomerata* (Pantidou, 1973).

Diaporthales

Diaporthe mattfeldii Petrak
On *Cistus monspeliensis* (Petrak, 1943a).

Diaporthe medusaea Nitschke
On *Citrus aurantium* (Apostolidis, 1952).

Diaporthe neapolitana Sacc.
Mt. Pilion (Magnesia): on *Carpobrotus acinaciformis* (Maire & Politis, 1940).

Diatrypales

Diatrype disciformis (Hoffm.) Fr.
Mt. Pilion (Magnesia): on *Fagus* sp. (Maire & Politis, 1940); NPR of Mt. Olympos, NPR of Pindos, and PF of Fracto (Drama): on *Fagus sylvatica* (Avtzis & Diamandis, 1988); Mt. Ossa (Larissa): on *Tilia* sp., and Mt. Olympos: on *Fagus sylvatica* (Minter, 1988).

Diatrype stigma (Hoffm.) Fr.
Feneos (Korinthia): on *Quercus conferta*, Mt Pilion (Magnesia): on *Castanea sativa*, and Kalambaka (Trikala): on *Quercus* sp. (Maire & Politis, 1940); Mt. Olympos: on *Quercus* sp., Mt. Ossa (Larissa): on *Tilia* sp., and Karyai (Agion Oros): on dead bark (Minter, 1988).

Diatrypella favacea (Fr.) Sacc.
Mt. Ossa (Larissa): on *Fagus* sp. (Minter, 1988).

Diatrypella quercina (Pers.) Cooke
Feneos (Korinthia): on *Quercus conferta* (Maire & Politis, 1940); Meteora (Trikala): on *Quercus* sp., and Mt. Olympos: on *Quercus pubescens* (Minter, 1988).

Eutypa lata f. *platani* Maire
Lagada (Lakonia): on *Platanus orientalis* (Maire & Politis, 1940).

Dothideales

Hysterium alneum (Ach.) J. Schröt.
Tatoi (Attiki): on *Quercus lanuginosa* (Maire & Politis, 1940).
Correct name for this fungus is probably *Hysterium pulicare* Pers.

Hysterium angustatum Alb. & Schwein.
Polygiros (Halkidiki): on *Pinus nigra* (Minter, 1988).

Hysterium pulicare Pers.
Aidipsos (Evvoia): on *Quercus* sp. (Maire & Politis, 1940).

Hysterographium flexuosum Maire
Mt. Ossa (Larissa): on *Fagus* sp. (Maire & Politis, 1940).

Hysterographium fraxini (Pers.) De Not
Panagia Kliston (Attiki): on *Phillyrea media* (Maire & Politis, 1940); Stavronikita Monastery (Agion Oros): on *Olea europaea* (Minter, 1988).

Hysterographium grammodes (De Not.) Sacc.
Island of Crete: on *Juniperus phoenicea* and *Pistacia lentiscus* (Petrak, 1943b).

Hysterographium pumilionis Rehm
Tempi valley (Larissa): on *Carpinus duinensis* (Maire & Politis, 1940).

"Karschia" sordidae Steiner
Mt. Mega-Isoma and Palaia Yiannitsou (Fthiotida): on *Lecanora sordida* (Maire & Politis, 1940).
Unfortunately Steiner's holotype specimen is mising both in W and WU and the placement of this species is doubtful (Haffelner, 1979).

Karschia talcophila (Ach. ex Flot.) Körb.
Mt. Penteli (Attiki): on *Diploschistis ochraceus* (Maire & Politis, 1940).

Myriangium duriaei Mont. & Berk.
Lagada (Lakonia): on *Acer creticum* (Maire & Politis, 1940).

Rhopographus filicinus (Fr.) Nke.
Elati (Trikala) and Mt. Olympos: on *Pteridium aquilinum* (Minter, 1988).

Helotiales

Ascocoryne sarcoides (Jacq.) J. W. Groves & D. E. Wilson
Mt. Ossa: on *Fagus* sp. (Maire & Politis, 1940); XX: on *Pinus sylvestris* and *Fagus sylvatica* (Diamandis, 1983); PF of Fracto (Drama): on *Fagus sylvatica* (Avtzis & Diamandis, 1988); on *Fagus* spp. (Diamandis, 1992).

Bisporella citrina (Batsch) Korf & S.E. Carp.
Syn. *Calycella citrina* (Batsch) Boud.
Mt. Ossa (Larissa): on *Fagus* sp. (Maire & Politis, 1940); NPR of Mt. Olympos and PF of Fracto (Drama): on *Fagus sylvatica* (Avtzis & Diamandis, 1988); on *Fagus* spp. and *Quercus conferta* (Diamandis, 1992); Proastio (Messinia): on hardwood, 12 Oct. 1997 (Zervakis, NAGREF-IK); Mt. Oxia (Fthiotida): on *Fagus sylvatica,* Oct. 1987 (Dimou, AUA-LGAM).

Bisporella pallescens (Pers.) S. E. Carp. & Korf
Syn. *Calycella lenticularis* (Bull.) Boud.
Mt. Parnassos (Maire & Politis, 1940).
According to Dennis (1956) *Peziza (Calycella) lenticularis* is conspecific with *Bisporella monilifera* Fuckel; the valid name for this taxon is as shown above.

Bulgaria inquinans (Pers.) Fr.
Mt. Parnassos (Maire & Politis, 1940); on *Quercus conferta* (Diamandis, 1992); Gardiki (Fthiotida): on *Quercus* sp., 29 Oct. 1987 (Dimou, AUA-LGAM).

Chlorociboria aeruginascens (Nyl.) Kanouse
Syn. *Chlorosplenium aeruginascens* (Nyl.) P. Karst.
On *Quercus* sp. (Diamandis, 1992).

Ciboria americana (Durand) Korf
Mt. Olympos: on *Castanea sativa*, and Karyai (Agion Oros): on *Castanea sativa* (Minter, 1988).

Cudoniella clavus (Alb. & Schwein.) Dennis
On plant residues under *Fagus sylvatica* (Diamandis, 1985).

Belonidium cerinum (Fr.) Raitv.
Syn. *Dasyscypha cerina* (Fr.) Fuckel
Mt. Ossa (Larissa): on *Fagus* sp. (Maire & Politis, 1940).

Dennisodiscus prasinus (Quél.) Svrček
Syn. *Lachnella prasina* Quél.
Sparti (Lakonia): on *Euphorbia veneta* (Maire & Politis, 1943).

Durandiella gallica Morelet
NPR of Mt. Olympos: on *Abies borisiiregis* and PF of Fracto (Drama): on *Picea abies* (Avtzis & Diamandis, 1988).
This species has been reported only on *Abies alba* in Europe. That is why, although *Abies borisiiregis* is closely related to *A. alba*, we have some doubts about this record.

Hyaloscypha hyalina (Pers.) Boud.
On *Populus* sp. (Diamandis, 1985).

Hymenoscyphus fructigenus (Bull.) Gray
Island of Andros, Messatouri: on *Quercus* sp., 30 Nov. 1993 (Lizoň, CUP), Gides: on *Quercus ilex,* 9 Dec. 1994 (Lizoň, CUP), Koumani: on *Quercus coccifera*, 15 Dec. 1995 (Lizoň, CUP); Mt. Ossa (Larissa) on *Fagus sylvatica,* 27 Nov. 1996 (Zervakis, NAGREF-IK).

Hymenoscyphus scutula (Pers.) Phillips
Island of Andros, Dipotamata river valley: on dead stems, 29 Nov. 1993 (Lizoň, CUP).

Hymenoscyphus virgultorum (F. H. Wigg.) W.Phillips
Syn. *H. calyculus* (Sowerby) W. Phillips
Mt. Oxia (Fthiotida): on *Fagus sylvatica,* 24 Oct. 1998 (Dimou, AUA-LGAM).

Hyphoscypha aureliella (Nyl.) Huhtinen
Syn. *Hyaloscypha resinifera* Höhn.
Mt. Taygetos: on *Abies cephalonica* (Maire & Politis, 1940, as *"Hyphoscypha" r.).*

Lachnellula calycina (Schum.) Sacc.
Syn. *Trichoscypha calycina* (Schum.) Boud.
Mt. Chelmos (Achaia): on *Abies cephalonica* (Maire & Politis, 1940).

Lachnellula subtilissima (Cooke) Dennis
Syn. *Lachnella subtilissima* (Cooke) W. Phillips
Mt. Mainalon (Arkadia): on *Abies cephalonica* (Diamandis & Minter, 1981); NPR of Mt. Olympos and PF of Fracto (Drama): on *Abies borisii-regis* (Avtzis & Diamandis, 1988); on *Abies cephalonica* and *A. borissi-regis* (Diamandis, 1992).

Lachnum soppittii (Massee) Lizoň, comb. nov.
Basionym: *Dasyscyphus soppittii* Massee, Brit. Fung. Fl., p. 330, 1895.
Island of Andros, Sineti: on *Acer monspessulatum* and *Quercus coccifera,* 2 Dec. 1993 (Lizoň, CUP), Evrousses: on *Acer monspessulatum,* 4 Dec. 1994 (Lizoň, CUP), Apikia: on *Quercus* sp., 2 Dec. 1995 (Lizoň, CUP), Achla river valley: on *Acer ?sempervirens,* 8 Dec. 1994 (Lizoň, CUP).

Lachnum virgineum (Batsch) P. Karst.
Syn. *Dasyscyphus virgineus* (Batsch) Gray
Mt. Parnassos: on twigs (Maire & Politis, 1940); Mt. Olympos: on *Pinus nigra* (Minter, 1988).

Mitrula paludosa Fr.
On *Pinus sylvestris* (Diamandis, 1992).

Mollisia cinerea (Batsch) P. Karst.
Mt. Ossa (Larissa): on *Fagus* sp. (Maire & Politis, 1940); Mt. Olympos: on *Pinus nigra* (Minter, 1988).

Orbilia xanthostigma (Fr.) Fr.
On *Fagus sylvatica* (Diamandis, 1985).

Phacidium lacerum (Fr.) Fr.
Karyai (Agion Oros): on *Pinus halepensis*, and Taxiarchis (Halkidiki): on *Pinus nigra* (Minter, 1988).

Phialina pseudotuberula (Graddon) Raitv.
Island of Andros, Evrousses: on *Acer monspessulatum,* 4 Dec. 1994 (Lizoň, CUP).

Rutstroemia echinophila (Bull.) Höhn.
Mt. Ossa (Larissa): on *Castanea sativa*, Karyai (Agion Oros): on *Castanea sativa*, and Vassilika (Thessaloniki): on *Quercus macrolepis* (Minter, 1988).

Rutstroemia firma (Pers.) P. Karst.
Karyai and Philotheou Monastery (Agion Oros): on *Castanea sativa* (Minter, 1988).

Rutstroemia petiolorum (Roberge) White
Mt. Ossa (Larissa): on *Quercus pubescens* (Minter, 1988).

Rutstroemia sydowiana (Rehm) White
Mt. Olympos: on *Quercus coccifera* and *Castanea sativa*, Mt. Ossa (Larissa): on *Quercus pubescens* and on *Castanea sativa*, Iberon Monastery (Agion Oros): on *Quercus pubescens*, Karyai and Philotheou Monastery (Agion Oros): on *Castanea sativa*, and Vassilika (Thessaloniki) on *Quercus trojana* (Minter, 1988).

Trichoglossum hirsutum (Pers.) Boud.
Syn. *Geoglossum hirsutum* Pers.
Leukas: under *Olea* sp. (Maire & Politis, 1940).

Trochila ilicina (Nees) Greenh. & Morgan-Jones
Syn. *Trochila ilicis* (Fr.) Crouan
Mt. Ossa (Larissa): on *Ilex aquifolium* (Maire & Politis, 1940).

Vibrissea truncorum (Alb. & Schwein.) Fr.
PF of Fracto (Drama): on *Pinus sylvestris* (Avtzis & Diamandis, 1988); PF of Fracto (Drama): on *Picea abies* (Diamandis & Perlerou, 1990); on *Fagus orientalis* (Diamandis, 1992); Gardiki (Fthiotida): on *Abies cephalonica*, 29 May 1992 (Dimou, AUA-LGAM).

Hypocreales

Hypocrea rufa (Pers.) Fr.
On *Abies borisii-regis* (Diamandis, 1992).

Hypomyces lateritius (Fr.) Tul.
Syn. *Peckiella lateritia* (Fr.) Maire
Mt. Taygetos: on *Lactarius deliciosus* (Maire & Politis, 1940).

Hypomyces chrysospermus Tul.
Krania (Larissa): on *Boletus* sp. (Maire & Politis, 1940).

Nectriella miltina (Mont.) Sacc.
Patissia (Attiki): on *Agave americana*, and island of Kerkyra (Maire & Politis, 1940).

Nectria sanguinea Fr.
Island of Zakynthos (Maire & Politis, 1940).

Lecanorales

Carbonea vitellinaria (Nyl.) Hertel
Syn. *Nesolechia vitellinaria* Rehm
Mt. Oiti (Fthiotida), Mt. Godaman (Larissa): on *Caloplaca vitellina* (Maire & Politis, 1940).

Carbonea halacsyi (Steiner) Haffelner & Sancho
Syn. *Nesolechia halacsyi* Steiner
Mt. Ziria (Korinthia), Mt. Oiti (Fthiotida): on *Rhizocarpon geographicum* (Maire & Politis, 1940).

Nesolechia oxysporiza Steiner
Mt. Godaman (Larissa): on *Lecanora polytropa* (Maire & Politis, 1940).

Rhizocarpon advenulum (Leighton) Haffelner
Syn. *Karschia advenula* (Leight) Zopf
Mt. Godaman (Larissa): on *Lecanora atra* (Maire & Politis, 1940).

Scutula aspiciliae (Metzl.) Rehm
Island of Kerkyra: on *Verrucaria calciseda* (Maire & Politis, 1940).

Leotiales

Leotia lubrica Pers.
Mt. Ossa (Larissa): under *Fagus sylvatica,* 27 Nov. 1996 (Zervakis, NAGREF-IK).

Neobulgaria pura (Fr.) Petrak
On *Fagus* sp. (Diamandis, 1983); NPR of Mt. Olympos, NPR of Pindos, and PF of Fracto (Drama): on *Fagus sylvatica* (Avtzis & Diamandis, 1988).

Ostropales

Schizoxylon asphodeli Maire
Manolada (Elia): on *Asphodelus microcarpus* var. *messeniacus* (Maire & Politis, 1940).

Schizoxylon graecum Höhn.
Island of Kerkyra: on *Olea* sp. (Maire & Politis, 1940).

Stictis mollis Pers.
Mt. Olympos: on *Pinus leucodermis* (Minter, 1988).

Stictis panizei De Not.
Kalamata (Messinia): on *Olea* sp. (Maire & Politis, 1940).

Stictis radiata Pers.
Mt. Olympos: on *Arbutus unedo* (Minter, 1988).

Patellariales

Lecanidion atratum (Hedw.) Rabenh.
Preveza: on wood (Maire & Politis, 1940).

Rhinodina insularis (Arnold) Haffelner
Island of Aegina (Attiki): on members of *Lecanora rupicola* group (Haffelner, 1979; GZU or M).

Pezizales

Aleuria aurantia (Pers.) Fuckel
Mt. Mainalon (Arkadia): under *Abies cephalonica* (Diamandis & Minter, 1983); Island of Andros, Vourkoti: in mossy stands, 12 Nov. 1995 (Polemis, AUA-LGAM); Mt. Pilion (Magnesia): in meadows and *Fagus sylvatica* forest roadsides, 28 Oct. 1986 (Dimou, AUA-LGAM).

Aleuria cornubiensis (Berk. & Broome) J. Moravec
Syn. *Melastiza chateri* (W.G. Sm.) Boud.
Island of Crete: on wood (Pantidou, 1991); PF of Fracto (Drama): in mixed forests of *Pinus sylvestris*, *Picea abies* and *Fagus orientalis* (Diamandis & Perlerou, 1990).

Anthracobia melaloma (Alb. & Schwein.) Boud.
Manolada (Elia): on burned ground (Maire & Politis, 1940).

Ascobolus furfuraceus Pers.
Island of Zakynthos (Maire & Politis, 1943).

Ascophanus testaceus (Moug.) W. Phillips
Ionian Islands: on cow's dung (Maire & Politis, 1940).

Caloscypha fulgens (Pers.) Boud.
Mt. Mainalon (Arkadia): under *Abies cephalonica* (Diamandis & Minter, 1983); NPR of Mt. Olympos: under *Abies borisii-regis* (Avtzis & Diamandis, 1988); Gardiki (Fthiotida): in mossy stands under *Abies cephalonica*, 29 May 1992 (Dimou, AUA-LGAM).

Cheilymenia granulata (Bull.) J. Moravec
Syn. *Coprobia granulata* (Bull.) Boud.
Island of Zakynthos (Maire & Politis, 1940).

Geopora arenicola (Lév.) Kers
Syn. *Scutellinia arenosa* (Velen.) Le Gal
Lapa (Achaia): on wet soil under *Pinus halepensis* (Moravec, 1974).

Geopora sumneriana (Cooke) M. Torre
Syn. *Sepultaria sumneriana* (Cooke) Massee
Under *Cedrus atlantica* (Diamandis, 1985); NPR of Mt. Olympos: under *Abies borisii-regis* (Avtzis & Diamandis, 1988); Mt. Oiti (Fthiotida): under *Abies* sp. (Keltemlidis, 1990); under *Cedrus deodara* (Diamandis, 1992)

Geopyxis carbonaria (Alb. & Schwein.) Sacc.
Mt. Taygetos (Messinia): on burned ground under *Pinus nigra* and *Abies cephalonica*, Apr.-May 1999 (Zervakis & Polemis, NAGREF-IK).

Gyromitra esculenta (Pers.) Fr.
NPR of Mt. Olympos: under *Pinus nigra* (Avtzis & Diamandis, 1988); Mt. Ossa (Larissa): Under *Fagus sylvatica* (Minter, 1988); Megalohori (Lesvos): under *Pinus* sp. (Keltemlidis, 1990); under *A. borisii-regis* (Diamandis, 1992).

Gyromitra infula (Schaeff.) Quél.
Under *Pinus sylvestris* and *Fagus orientalis* (Diamandis, 1992); Mt. Oxia (Fthiotida): under *Fagus sylvatica*, 30 Oct. 1994 (Dimou, AUA-LGAM), and Gardiki (Fthiotida): under *Abies cephalonica*, 9 Nov. 1996 (Dimou, AUA-LGAM).

Gyromitra perlata (Fr.) Harmaja
Syn. *Discina perlata* (Fr.) Fr.
Mt. Mainalon (Arkadia): under *Abies cephalonica* (Diamandis & Minter, 1983); NPR of Mt. Olympos: under *Abies borisii-regis*, and PF of Fracto (Drama): under *Fagus sylvatica* (Avtzis & Diamandis, 1988); Mt. Taygetos (Messinia): on mossy ground under *Abies cephalonica*, 3 May 1999 (Zervakis & Polemis, NAGREF-IK).

Helvella acetabulum (L.) Quél.
Syn. *Paxina acetabulum* (L.) Kuntze
Under *Pinus nigra* (Diamandis, 1985); under *Castanea sativa* (Diamandis, 1992).

Helvella crispa Scop.
Under *Abies cephalonica* (Pantidou, 1973); Mt. Mainalon (Arkadia): under *Abies cephalonica* (Diamandis & Minter, 1981); under *Abies borisii-regis* (Diamandis, 1985); NPR of Mt. Olympos: under *Abies borisii-regis* (Avtzis & Diamandis, 1988); Greece (Pantidou, 1991); Proastio (Messinia): under *Quercus coccifera*, 6 Dec. 1997 (Zervakis, NAGREF-IK), Oropos (Attiki): under *Pinus halepensis*, Dec. 1997 (Zervakis, NAGREF-IK), Island of Andros, Apoikia: under *Quercus* sp., 2 Jan. 1999 (Polemis, AUA-LGAM), Island of Naxos, Apeiranthos: under *Quercus coccifera*, 17 Jan. 1999 (Polemis, NAGREF-IK) and Mt. Ossa (Larissa) under *Fagus sylvatica,* 27 Nov. 1996 (Zervakis, NAGREF-IK).

Helvella elastica Bull.
Syn. *Leptopodia elastica* (Bull.) Boud.
Under *Abies cephalonica* and *A. borisii-regis* (Diamandis, 1992).

Helvella ephippium Lév.
Island of Andros, Vrachnou: under shrubs, 6 Dec. 1994 (Lizoň, CUP).

Helvella lacunosa Afz.
Mt. Mainalon (Arkadia): under *Abies cephalonica* (Diamandis & Minter, 1981); under *Populus* spp. (Diamandis, 1985); PF of Fracto (Drama): under *Picea abies* (Avtzis & Diamandis, 1988); Greece (Pantidou, 1991); XX: under *Abies cephalonica* and *A. borisii-regis*, and in sandy fields (Diamandis, 1992); Mt. Ossa (Larissa): under *Fagus sylvatica*, 27 Nov. 1996 (Zervakis, NAGREF-IK), Mt. Taygetos: under *Abies cephalonica*, Oct.-Dec. 1996 (Zervakis, NAGREF-IK) and Gardiki (Fthiotida): under *Abies cephalonica*, 9 Nov. 1996 (Dimou, AUA-LGAM).

Helvella leucomelaena (Pers.) Nannf.
Syn. *Paxina leucomelas* (Pers.) Kuntze
Under *Pinus* sp. (Pantidou, 1991); under *Pinus brutia* and *P. halepensis* (Diamandis, 1992).

Helvella queletii Bres.
Dyrrahi (Arkadia): under *Quercus pubescens*, 8 May 1999 (Zervakis & Polemis, NAGREF-IK).

Humaria hemisphaerica (F. W. Wigg.) Fuckel
Syn. *Mycolachnea hemisphaerica* (F. W. Wigg.) Maire
Island of Andros, Vrachnou: under *Quercus brachyphylla,* 5. Dec. 1994 (Lizoň, CUP); Mt. Parnitha (Attiki): under *Abies cephalonica*, 5 Nov. 1996 (Dimou, AUA-LGAM); Island of Naxos, Koronida: under *Quercus coccifera,* 13 Jan. 1999 (Polemis, NAGREF-IK).

Iodophanus carneus (Pers.) Korf
Dion (Pieria): on *Fraxinus excelsior* (Minter, 1988).

Morchella conica (Pers.) Boud.
Islands of Kerkyra and Lefkada (Maire & Politis, 1940); Mt. Mainalon (Arkadia): under *Abies cephalonica* (Diamandis & Minter, 1981); Filakio (Evros): in mixed forests of *Alnus glutinosa*, *Astragalus* sp. and *Rubus tomentosus*, Mt. Xiro (Evvoia): under *Pinus nigra* and *A. cephalonica*, Plastiras (Karditsa): under *A. borissii-regis*, Mt. Kissavos (Larissa): under *Fagus sylvatica*, Mt. Olympos (Pieria): under *Abies cephalonica*, Mt. Chelmos (Achaia): under *Abies cephalonica*, and Kastania (Trikala): under *Fagus sylvatica* and *Abies cephalonica* (Philipoussis & Balis, 1995); Karveli (Messinia): on gravel, 8 Apr. 1997 (Zervakis, NAGREF-IK), Dionysos (Attiki): under *Quercus coccifera.* 14 Apr. 1997 (Dimou, AUA-LGAM), Mt. Taygetos (Messinia): on burned ground under *Abies cephalonica* and *Pinus nigra*, Apr.-May 1999 (Zervakis & Polemis, NAGREF-IK).
Taxonomy and nomenclature of the members of *Morchella* follow Jacquetant (1984).

Morchella deliciosa Fr.
Larissa: in field (Philipoussis & Balis, 1995).

Morchella elata Fr.
Under *Abies cephalonica* and *Pinus* sp. (Pantidou, 1973); Mt. Mainalon (Arkadia): under *Abies cephalonica* (Diamandis & Minter, 1981); Mt. Chelmos (Achaia): under *Abies cephalonica*, Plastiras (Karditsa): under *Abies borisii-regis*, Pertouli (Trikala): under *Abies borisii-regis*, and Mt. Parnonas (Arkadia): under *Abies cephalonica* (Philipoussis & Balis, 1995).

Morchella esculenta (L.) Pers.
Syn. *Morchella esculenta* var. *rotunda* Pers., *Morchella rotunda* (Pers.) Boud.
Milea (Evros): in mixed forests of *Morus nigra* and *Populus canadensis*, Filakio (Evros): in mixed forests of *Alnus glutinosa*, *Populus canadensis* and *Rubus* sp., Pentalofos (Evros): in mixed forests of *Betula verucosa*, *Quercus pubescens* and *Rubus tomentosus*, Vitina (Arkadia): under *Abies cephalonica*, Mt. Ossa (Larissa): under

Fagus sylvatica and *Abies cephalonica*, and Pertouli (Trikala): under *Abies borisii-regis* (Philipoussis & Balis, 1995).

Morchella esculenta var. *rigida* (Pers.) Boud.
Syn. *Morchella rotunda* var. *rigida* (Pers.) Boud.
Mt. Mainalon (Arkadia): under *Abies cephalonica* (Diamandis & Minter, 1981); Filakio (Evros): in mixed forests of *Alnus glutinosa*, *Populus canadensis* and *Rubus tomentosus*, and Milea (Evros): in mixed forests of *Robinia pseudoacacia* and *Populus canadensis* (Philipoussis & Balis, 1995).

Morchella esculenta var. *deliciosa* (Boud.) Jacq.
Orestiada (Evros): in field (Philipoussis in litt.).

Morchella rotunda var. *crassipes* (Pers.) Boud.
Pentalofos (Evros): in mixed forests of *Betula verrucosa*, *Quercus pubescens* and *Rubus tomentosus* (Philipoussis & Balis, 1995).

Morchella hortensis Boud.
Therapio (Evros): in mixed forests of *Ulmus campestris* and *Rubus tomentosus* (Philipoussis & Balis, 1995).

Morchella vulgaris (Pers.) Boud.
Syn. *Morchella esculenta* var. *vulgaris* Pers.
Mt. Mainalon (Arkadia): under *Abies cephalonica* (Diamandis & Minter, 1981); under *Abies cephalonica* and *Quercus conferta* (Diamandis, 1992); Milea (Evros): in mixed forests of *Robinia pseudoacacia* and *Populus canadensis*, Filakio (Evros): in mixed forests of *Alnus glutinosa*, *Astragalus* sp. and *Rubus tomentosus*, Pinios (Larissa): in mixed forests of *Populus canadensis* and *Pinus nigra*, and Platamonas (Larissa): under *Malus sylvestris* (Philipoussis & Balis, 1995).

Morchella vulgaris var. *pseudoumbrina* (Pers.) Boud.
Therapio (Evros): in mixed forests of *Ulmus campestris* and *Rubus tomentosus* (Philipoussis & Balis, 1995).

Otidea alutacea (Pers.) Massee
Under *Abies borisii-regis* (Diamandis, 1992); Island of Andros, Kato Evrousses: under *Quercus brachyphylla*, 4 Dec. 1994 (Polemis, AUA-LGAM), Vrachnou: under *Quercus brachyphylla,* 5 Dec. 1994 (Lizoň, CUP).

Otidea bufonia (Pers.) Boud.
Under *Abies borisii-regis* (Diamandis, 1992); Island of Andros, Evrousses: under *Quercus macrolepis* (Lizoň, CUP); Gardiki (Fthiotida): under *Abies* cephalonica, 9 Nov. 1996 (Dimou, AUA-LGAM); Dyrrahi (Arkadia): under *Quercus pubescens,* 20 Oct. 1996 (Zervakis, NAGREF-IK), Chrysohori (Messinia): under *Quercus pubescens*, 3 Nov. 1996 (Zervakis, NAGREF-IK).

Otidea cochleata (L.) Fuckel
Island of Zakynthos (Maire & Politis, 1940).

Otidea leporina (Batsch) Fuckel
Mt. Mainalon (Arkadia): under *Abies cephalonica* (Diamandis & Minter, 1983); on rotten wood under *Abies* sp. (Pantidou, 1991).

Peziza arvenensis Boud.
Under *Fagus* sp. (Diamandis, 1992); Mt. Oxia (Fthiotida): under *Fagus sylvatica,* 23 Oct. 1998 (Dimou, AUA-LGAM).

Peziza cerea Sowerby
Lapas (Achaia): on mixture of soil and dung (Moravec, 1974).

Peziza michelii (Boud.) Dennis
Island of Andros, Lamira: in pasture, 21 Nov. 1994 (Lizoň, CUP).

Peziza micropus Pers.
PF of Fracto (Drama): on *Fagus* sp. (Avtzis & Diamandis, 1988); Mt. Olympos on *Abies* sp. (Minter, 1988); PF of Fracto (Drama): on *Fagus orientalis* (Diamandis & Perlerou, 1990).

Peziza repanda Pers.
Elati (Trikala): under *Abies* sp. (Minter, 1988).

Peziza succosa Berk.
Under *Fagus sylvatica* (Diamandis, 1992).

Peziza vesiculosa Bull.
Mt. Mainalon (Arkadia): under *Abies cephalonica* (Diamandis & Minter, 1981); on dung and or humus-rich soils (Diamandis, 1985).

Peziza violacea Pers.
Mt. Taygetos (Messinia): on burned ground under *Pinus nigra* and *Abies cephalonica*, Apr.-May 1999 (Zervakis & Polemis, NAGREF-IK).

Pithya vulgaris Fuckel
Mt. Mainalon (Arkadia): on *Abies cephalonica* (Diamandis & Minter, 1981); NPR of Mt. Olympos: on *Abies borisii-regis* (Avtzis & Diamandis, 1988); Elati (Trikala): on *Abies borissi-regis* and *Pinus nigra* (Minter, 1988).

Plicaria trachycarpa (Currey) Boudier
Mt. Taygetos (Messinia): on burned ground under *Pinus nigra* and *Abies cephalonica*, Apr.-May 1999 (Zervakis & Polemis, NAGREF-IK).

Ramsbottomia asperior (Nyl.) Benkert & T. Schumach.
Island of Andros, Menites: on stony soil, 28 Nov. 1994 (Lizoň, CUP).

Sarcoscypha coccinea agg.
Kiourka (Attiki): on *Olea europaea* (Maire & Politis, 1940); Meteora (Trikala): on *Quercus pubescens*, Kastanea (Trikala): on *Quercus pubescens*, Mt. Olympos: on *Pinus* sp. (Minter, 1988); on *Alnus glutinosa* (Diamandis, 1992).

Older records reported under this name, when not backed by herbarium specimens, are doubtful because *S. coccinea* s. l. represents in current sense in Europe at least four independent species.

Sarcoscypha coccinea (Jacq.) Lamb.
Megalo Chorio (Evrytania): on *Platanus* sp., 8 Jan. 1999 (Dimou, AUA-LGAM).

Sarcosphaera coronaria (Jacq.) J. Schröt.
Syn. *Sarcosphaera eximia* (Dur. & Lev.) Maire
Syn. *Sarcosphaera crassa* (Santi ex Steudel) Pouz.
Island of Ikaria, Mt. Oiti (Fthiotida), Stamata (Attiki), Mt. Ainos (Kefallonia), Pandroso (Samos) and Kalavryta (Achaia) (Keltemlidis, 1990); under conifers (Pantidou, 1991); under *Abies cephalonica* and *A. borisii-regis* (Diamandis, 1992); Mt. Taygetos (Messinia), Neohori: on mossy ground under *Abies cephalonica*, 8 May 1999 (Zervakis & Polemis, NAGREF-IK).

Scutellinia peloponnesiaca J. Moravec
Lapa (Achaia): on soil among grasses (Moravec, 1974).

Scutellinia scutellata (L.) Lambotte
Platylithos (Phokida): on *Abies* sp., and Mt. Parnassos (Maire & Politis, 1940); NPR of Mt. Olympos, NPR of Pindos and PF of Fracto (Drama): on *Fagus sylvatica* (Avtzis & Diamandis, 1988); Kastanea (Trikala): on *Quercus pubescens* (Minter, 1988); on *Abies cephalonica*, *A. borisii-regis* and *Pinus nigra* (Diamandis, 1992); Mt. Ossa (Larissa): on *Fagus sylvatica,* 27 Nov. 1996 (Zervakis, NAGREF-IK).

Scutellinia trechispora (Berk. & Broome) Lambotte
Manolada (Elia): on soil (Maire & Politis, 1940).

Scutellinia parvispora J. Moravec
Levadia (Voiotia): on soil under *Ficus* sp. (Moravec, 1974).

Sowerbyella imperialis (Peck) Korf
Under *Abies borisii-regis* (Diamandis, 1992): in *Abies cephalonica* (Diamandis & Perlerou, 1994).

Tarzetta catinus (Holmsk.) Korf & J. E. Rogers
Syn. *Peziza catinus* Holmsk.
Kryoneri (Thessaloniki): in *Pinus* sp. (Keltemlidis, 1990).

Terfezia arenaria (Moris) Trappe
Syn. *Terfezia leonis* (Tul. & C. Tul.) Tul. & C. Tul.
Myrtountion (Elia) and Dymi (Achaia) (Maire & Politis, 1940); Olvio, Dekarho, Orfano and Evlalo (Xanthi): in *Artemisia communis* and *Helianthemum guttatum* communities, Kozani, Peloponnese, and in the islands of Crete and Kalymnos (Keltemlidis, 1990).

Terfezia fanfani Matt.
Manolada (Elia): on sandy soil among *Helianthemum guttatum* (Maire & Politis, 1940).

Tricharina cretea (Cooke) J. Moravec
Levadia (Voiotia): on calcareous soil under *Ficus* sp. (Moravec, 1974).

Tuber aestivum Vittad.
Under *Quercus* sp. (Pantidou, 1973).

Tuber genadii Pat.
Dymi (Achaia) and Myrtountion (Elia) (Maire & Politis, 1940).

Tuber melanosporum Vittad.
(Landerer 1854).

Verpa conica (O.F. Müll.) Schwartz
Mt. Ainos (Kefallonia) (Pantidou, 1991).

Phyllachorales

Polystigma rubrum (Pers.) DC.
Lagada (Lakonia) and Lefkaditi (Phokida): on *Prunus spinosa*, Mt. Parnassos and Mt.Pilion (Magnesia): on *Prunus pseudarmeniaca*, Krania (Larissa): on *Prunus domestica* (Maire & Politis, 1940).

Polystigma rubrum var. *amygdali* Desm.
Aidipsos (Evvoia) and Delphi (Phokida): on *Prunus amygdalus* (Maire & Politis, 1940).

Rhytismatales

Coccomyces coronatus (Schumach.) De Not.
Leucas: on *Quercus pedunculiflora* (Maire & Politis, 1940).

Coccomyces dentatus (Kuntze & Schm.) Sacc.
Mt. Penteli (Attiki): on *Quercus coccifera* (Maire & Politis, 1940).

Colpoma quercinum (Pers.) Wallroth
Mt. Ossa (Larissa): on *Quercus* sp. (Minter, 1988).

Hypoderma hederae De Not.
Mt. Olympos: on *Hedera helix* (Minter, 1988).

Lophodermella conjucta (Darker) Darker
Mt. Olympos: on *Pinus nigra* (Minter, 1988).

Lophodermium arundinaceum (Schrad.) Cheval.
Karyai (Agion Oros): on *Phragmites australis* (Minter, 1988).

Lophodermium gramineum (Fr.) Cheval.
Mt. Olympos: on Gramineae dead leaf (Minter, 1988).

Lophodermium juniperinum (Fr.) De Not.
Mt. Olympos: on *Juniperus oxycedrus* (Minter, 1988).

Lophodermium maculare (Fr.) De Not.
Mt. Taygetos: on *Pyrus amygdalifolia* (Maire & Politis, 1940).

Lophodermium minutum Hill.
On *Stipa* sp. (Petrak, 1956).

Lophodermium nervisequum (DC.) Darker
Elatovouno (Phokida) and Krania (Larissa): on *Abies* sp. (Maire & Politis, 1940); Mt. Mainalon (Arkadia): on *Abies cephalonica* (Diamandis & Minter, 1981).

Lophodermium paeoniae Rehm: Vestergren
Island of Crete: on *Paeonia clusii* (Petrak, 1943b).

Lophodermium petiolicola Fuckel
Mt. Olympos: on *Quercus pubescens* (Minter, 1988).

Lophodermium piceae (Fuckel) Höhn.
Mt. Mainalon (Arkadia): on *Abies cephalonica* (Diamandis & Minter, 1983); Elati (Trikala): on *Abies borisii-regis*, and Mt. Olympos: on *Abies appolonis* (Minter, 1988).

Lophodermium pinastri (Schrad.) Cheval.
On *Pinus halepensis* (Sarejanni, 1939); on *Pinus halepensis* (Alexopoulos, 1940); Mt. Taygetos: on *Pinus nigra* (Maire & Politis, 1940); on *Pinus* sp. (Kailidis, 1962); Taxiarchis (Halkidiki): on *Pinus nigra*; Kastanea (Trikala): on *Pinus nigra*, Mt. Olympos: on *Pinus nigra*, and on *Pinus leucodermis* (Minter, 1988).

Lophodermium sesleriae Hill.
On *Sesleria nitida* (Petrak, 1941); on *Oryzopsis coerulescens* (Petrak, 1943a); island of Crete: on *Sesleria doerferi* (Petrak, 1943b).

Lophodermium seditiosum Minter & al.
Taxiarchis (Halkidiki): on *Pinus nigra*, Mt. Olympos on *Pinus leucodermis* (Minter, 1988).

Melittosporum versicolor (Fr.) Corda
Syn. *Propolis versicolor* (Fr.) Fr.
Olympia (Elia): on *Quercus coccifera* (Maire & Politis, 1940).

Naemacyclus fimbriatus (Schweim.) DiCosmo & al.
Syn. *Lasiostictis fimbriata* (Schwein.) Bäuml.
Mt. Penteli (Attiki): on *Pinus halepensis* (Maire & Politis, 1940).

Propolis faginea (Schrad.) P. Karst.
Iberon Monastery (Agion Oros): on *Quercus ilex* (Minter, 1988).

Rhytisma acerinum (Pers.) Fr.
Chaliki (Mt. Pindos): on *Acer obtusatum,* Dholiana (Trikala): on *A. campestre,* Krania (Larissa): on *A. intermedium,* Mt. Baba (Thessalia): on *A. pseudoplatanus* (Maire & Politis, 1940).

Zeus olympius Minter & Diamandis
NPR of Mt. Olympos: on *Pinus leucodermis* (Minter & al., 1987).

Sordariales

Bertia moriformis (Tode) De Not.
Mt. Olympos: on dead wood (Minter, 1988).

Lasiosphaeria ovina (Fr.) Ces. & De Not.
Mt. Ossa (Larissa): on *Tilia* sp. (Minter, 1988).

Xylariales

Biscogniauxia numularia (Bull.) Kuntze
Syn. *Hypoxylon nummularium* Bull., *Nummularia bulliardii* Tul. & C. Tul.
Mt. Ossa (Larissa): on *Fagus* sp. (Maire & Politis, 1940); NPR of Mt. Olympos, NPR of Pindos and PF of Fracto (Drama): on *Fagus sylvatica* (Avtzis & Diamandis, 1988); Dyrrahi (Arkadia): on *Quercus pubescens,* 23 Aug. 1997 (Zervakis, NAGREF-IK).

Hypoxylon fragiforme (Pers.) J. Kickx fil.
Syn. *Hypoxylon coccineum* Bull.
Mt. Ossa (Larissa): on *Fagus* sp. (Maire & Politis, 1940); on *Fagus sylvatica* (Diamandis, 1983); NPR of Mt. Olympos, NPR of Pindos, and PF of Fracto (Drama): on *Fagus sylvatica* (Avtzis & Diamandis, 1988).

Hypoxylon multiforme (Fr.) Fr.
On *Fagus orientalis* (Diamandis, 1992).

Hypoxylon rubiginosum (Pers.) Fr.
Mt. Olympos: on *Arbutus unedo* (Minter, 1988).

Kretzschmaria deusta (Hoffm.) P. Martin
Syn. *Ustulina deusta* (Hoffm.) Lind.
NPR of Mt. Olympos: on *Fagus sylvatica* (Avtzis & Diamandis, 1988); Mt. Ossa (Larissa): on *Fagus sylvatica* (Minter, 1988); on *Fagus orientalis* (Diamandis, 1992).

Nemania serpens (Pers.) Gray
Syn. *Hypoxylon serpens* (Pers.) J. Kickx fil.
On *Fagus orientalis* (Diamandis, 1992).

Poronia punctata (L.) Petrak
Olympia (Elia): on dung of mule (Maire & Politis, 1940); Kastanea (Trikala): on horse dung (Minter, 1988).

Xylaria carpophila (Pers.) Fr.
Mt. Ossa (Larissa): on *Fagus sylvatica* (Minter, 1988).

Xylaria hypoxylon (L.) Grev.
Mt. Pilion (Magnesia) and Mt. Ossa (Larissa): on *Fagus* sp., and Mt. Taygetos: on *Quercus lanuginosa* (Maire & Politis, 1940); NPR of Mt. Olympos: on *Fagus sylvatica* (Avtzis & Diamandis, 1988); on *Fagus* spp., *Quercus conferta*, *Q. pubescens* and *Picea abies* (Diamandis, 1992); Mt. Oxia (Fthiotida): on *Fagus sylvatica,* 8 Oct. 1998 (Dimou, AUA-LGAM), Gardiki (Fthiotida): on *Alnus glutinosa,* 9 Oct. 1998 (Dimou, AUA-LGAM) and Mt. Pilion (Magnesia): on *Fagus sylvatica,* 5 Nov. 1995 (Dimou, AUA-LGAM).

Xylaria polymorpha Pers.
On *Fagus orientalis* (Diamandis, 1992).

Ascomycota inc. sed.

Abrothallus parmeliarum (Sommerf.) Nyl.
On *Parmelia perrugata* (Maire & Politis, 1940).

Abrothallus parmeliarum ssp. *petitmenginii* Harm.
Mt. Hymettos (Attiki) (Maire & Politis, 1940).

Cryptovalsa protracta (Fr.) Ces. & De Not.
Patras (Achaia): on *Vitis vinifera* (Maire & Politis, 1940).

Dactylospora rimulicola (Müll. Arg.) Haffelner
Syn. *Karschia rimulicola* (Müll. Arg.) Arnold
Argos (Argolida): on *Lecanora ceassa, L. albomarginata* (Maire & Politis, 1940)
According to Haffelner (1979) this species was reported only from former Czechoslovakia and Switzerland.

Dactylospora verruculosa Haffelner
Island of Crete: on decorticated wood (Haffelner, 1979; holotype in GZU).
The species was described from Greece.

Helotiella maireana Rehm
Mt. Kronion, Olympia (Elia): on *Quercus coccifera* (Maire & Politis, 1940).

Rhymbocarpus geographici (Steiner) Vouaux
Mt. Penteli (Attiki), Makriouni (Argolida): on *Rhizocarpon geographicum* (Maire & Politis, 1940).

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MYCOTAXON

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A REINTERPRETATION OF DALDINIA CONCENTRICA BASED UPON A RECENTLY DISCOVERED SPECIMEN

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ABSTRACT

A collection of Edward Robson, a correspondent of James Bolton, was recently discovered in the Sunderland Museum, UK. Examination of a specimen labelled ***Sphaeria concentrica*** convinces us that Bolton's concept of ***Daldinia concentrica*** was of a fungus with purple pigment extractable from the stroma in potassium hydroxide (KOH). This important species—the type of the genus—is reinterpreted herein. A new species, ***D. childiae***, is erected to embrace a widespread taxon with a yellow KOH-extractable pigment that has long been considered as ***D. concentrica*** pro parte. A key to ***Daldinia*** is included to reflect these reinterpretations and changes.

Key words: Bolton, ***Daldinia***, systematics, Xylariaceae

In 1997 a revision of ***Daldinia*** was published (Ju et al., 1997). One of the main problems facing the authors was the application of the name of the type species, ***Daldinia concentrica*** (Bolton: Fr.) Ces. & De Not., in the absence of type material. Child (1932), the monographer of the genus, had a broad concept of ***D. concentrica*** that, in the opinion of Ju et al. (1997), embraced several distinct taxa. Among the characters utilized by Ju et al. (1997), but not by Child (1932), were the color of stromatal pigments in 10% KOH and cultural features, including anamorphic data. Using stromatal pigment color in KOH (or the absence of pigment color) as the primary character to separate taxa, two species clusters emerged: a cluster of three species with more or less yellow pigments and a cluster of sixteen species with more or less purple pigments or with pigments apparently lacking altogether. One of the yellow-pigmented taxa is widespread throughout the world, particularly in temperate and subtropical regions (Ju et al., 1997). This taxon had been accepted by Child (1932), and virtually every other mycologist following her, as ***D. concentrica***. Unfortunately, in the British Isles—the type location for ***D. concentrica***—a purple-pigmented taxon had long been accepted as ***D. concentrica***. Child (1932) did not distinguish between yellow-pigmented and purple-pigmented material in her concept of ***D. concentrica***.

It had long been assumed that no Bolton material of ***D. concentrica*** is extant. Thus, we felt justified in using Bolton's painting of ***D. concentrica*** as type (Bolton, 1789). But what taxon was really represented by Bolton's illustration—the purple-pigmented taxon commonly accepted in the British Isles as ***D. concentrica*** or the yellow-pigmented taxon accepted in much of the rest of the world as ***D. concentrica***? As will be discussed later, the fungus traditionally considered to be ***D. concentrica*** in the British Isles occurs commonly on ***Fraxinus*** and, indeed, ***Daldinia*** on other hosts should be examined carefully to be certain of their identities (and see Table 1). Yet, Bolton's collection was made from "old thorns" (Bolton, 1789), probably a ***Crataegus*** sp. or even ***Prunus spinosa***, and in his notes in the possession of one of us (RW) he indicates that he had found it "in a less perfect state on an hasel stock," i.e., ***Corylus***. Moreover, yellow-pigmented specimens under ***Sphaeria concentrica*** and ***S. fraxinea***, with unknown localities, were examined from the Persoon herbarium and the yellow-pigmented taxon occurs in Europe (Ju et al., 1997). Although Ju et al. (1997) had never seen yellow-pigmented stromata among British Isles material prior to writing the revision they believed that it could occur there owing to the proximity to mainland Europe. It was thus considered that accepting Bolton's illustration as depicting a yellow-pigmented taxon representing the type of ***D. concentrica*** would inconvenience the fewest workers worldwide (not in the UK!). Ju et al. (1997) also erected ***D. petriniae*** Y.-M. Ju, J. D. Rogers, & San Martín for a purple-pigmented fungus that produces short, annellated conidiophores. They supposed a very similar purple-pigmented fungus in British Isles, Europe, and elsewhere, differing primarily in having a typical ***Nodulisporium*** Preuss anamorph, would eventually have to be named. That problem was not dealt with at the time of the revision owing to the lack of culturable material.

Prior to this time RW had purchased Bolton's original painting of ***Sphaeria concentrica*** as an interleaved inclusion in a copy of "History of fungusses" that had apparently belonged to Edward Robson of Darlington. RW with the aid of Alan W. Legg of Darlington began to investigate the life and activities of this correspondent and friend of Bolton. The matter stood thus until mid-winter, 1998 when RW informed JDR that herbarium sheets bearing specimens of Robson had been discovered at Sunderland Museum and called to his attention by Legg. The significance of this discovery was summarized aptly by Legg (1997), "Of far more historical significance is the fact that many of the herbarium sheets appear to be the original ones sent by Robson to Bolton and returned by the latter with comments. Not only do they bear at least four of Bolton's own collections, but some of them shed light on the real or likely identity of fungi illustrated and described by Bolton and his contemporaries which have posed problems of determination for later mycologists up to the present day." Accordingly, with great excitement and anticipation RW and JDR visited the Sunderland Museum in the company of A. W. Legg and examined the Robson material.

The Robson material consists of sections of a ***Daldinia*** stroma 2-3 mm thick and up to about 7 cm diam mounted on sheets, and some loose debris. Perithecia did not appear to be present, but a thorough search could not be made without destroying material. Fragments of material immersed in KOH released a purplish pigment. The material was labelled, as follows: "Sphaeria concentrica Mss; Lycoperdon fraxin Huds?; on stumps placed for seats in Captn Hope's pleasure grounds." According to Legg (1997) material of this collection sent from Darlington by Robson to Bolton might have been used for Bolton's illustration (Bolton, 1789); the layout and the constituents of the painting have numerous common features. Thus, although the host substrate is uncertain and the location of Hope's pleasure grounds has not been pinpointed, it is obvious that this material is of great importance in clarifying Bolton's concept of ***Sphaeria concentrica***. There can be little doubt that the material that he figured and described was a purple-pigmented taxon that occurred, among other hosts, on ***Fraxinus***. We thus emend our concept of Bolton's illustration (1789) based upon Robson's material and, consequently, ***Daldinia concentrica*** (see later).

In order to establish the frequency and distribution of ***D. concentrica*** in the British Isles the large ***Daldinia*** collection of AJSW was examined in detail. Several interesting facts have emerged (Table 1):

1. ***Daldinia concentrica*** is commonly encountered on ***Fraxinus*** in the British Isles. It is also represented in the collections from ***Fagus*** and ***Sorbus***.
2. ***Daldinia petriniae*** is apparently not represented in the material examined, based on stromatal surface morphology. Cultures could not be made from most of the material, however, and the anamorph is the most reliable character for separating this species from ***D. concentrica***.
3. The ***Daldinia*** on ***Betula*** is ***D. loculata*** (Lév.) Sacc., not ***D. concentrica*** as commonly supposed.
4. The single collection from ***Ulmus*** is ***D. grandis*** Child.
5. No taxa with yellow pigments have been seen among the many specimens examined from the British Isles.

Daldinia concentrica (Bolton: Fr.) Ces. & De Not., Comment. Soc. Crittog. Ital. 1: 197. 1863. Figs. 1-3

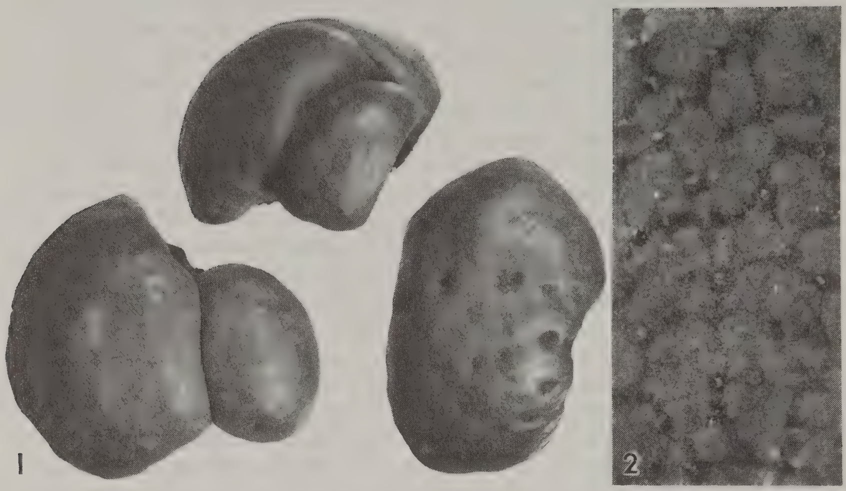
≡ ***Sphaeria concentrica*** Bolton, Hist. Fung. Halifax III, p. 180. 1789; Bolton: Fr., Syst. Mycol. II, p. 331. 1823; *non* Wahlenberg, 1812.

≡ ***Peripherostoma concentricum*** (Bolton: Fr.) S. F. Gray, Nat. Arr. Brit. Pl. I, p. 513. 1821.

≡ ***Stromatosphaeria concentrica*** (Bolton: Fr.) Grev., Fl. Edinensis, p. 355. 1824.

≡ ***Hypoxylon concentricum*** (Bolton: Fr.) Grev., Scot. Crypt. Fl. VI, Pl. 324. 1828.

≡ ***Hemisphaeria concentrica*** (Bolton: Fr.) Klotzsch, Acad. Caes. Leop. Nova Acta 19: 241. 1843.



Figs. 1, 2. ***Daldinia concentrica*** (Whalley 234). 1. Stromata; X0.66. 2. Stromatal surface; X16.

= ***Fungus fraxineus***, ***niger***, ***durus***, ***orbiculatus*** J. Ray, Hist. Pl. I, p. 109. 1686. *Fide* Fries (1823), Tulasne and Tulasne (1863), and Child (1932).
= ***Valsa tuberosa*** Scop., Fl. Carniol. II, ed. 2, p. 399. 1772. *Fide* Fries (1823), Tulasne and Tulasne (1863), Miller (1930), and Child (1932).
≡ ***Sphaeria tuberosa*** (Scop.) Timm, Fl. Megapol. Prodr., p. 279. 1788.
≡ ***Daldinia tuberosa*** (Scop.) J. Schröt., Jahresber. Schles. Ges. Vaterl. Cult. 59: 464. 1881.
≡ ***Hypoxylon tuberosum*** (Scop.) Wettst., Verh. K. K. Zool.-Bot. Ges. Wien 35: 591. 1885.
= ***Lycoperdon atrum*** Schaeff., Fungi Bavar. Palat. Nasc. IV, p. 131. 1774. *Fide* Persoon (1801), Fries (1823), Tulasne and Tulasne (1863), and Child (1932).
= ***Lycoperdon fraxineum*** Hudson, Fl. Angl. ed. 2, II, p. 641. 1778. *Fide* Fries (1823) and Child (1932).
= ***Sphaeria tunicata*** Tode, Fung. Mecklenb. Sel. II, p. 59. 1791. *Fide* Persoon (1801), Fries (1823), Tulasne and Tulasne (1863), Miller (1930), and Child (1932).
= ***Sphaeria fraxinea*** Sibth., Fl. Oxon., p. 401. 1794. *Fide* Persoon (1801), Fries (1823), Tulasne and Tulasne (1863), Miller (1930), and Child (1932).

Stromata spherical, depressed-spherical to turbinate, sessile, solitary to aggregated, smooth or with inconspicuous perithecial mounds, 2-8 cm diam x 1.2-4 cm high; surface frequently cracked into fine network, brown vinaceous (84), chestnut (40), or sepia (63), blackened and somewhat varnished in age; dull reddish brown granules immediately beneath surface, with KOH-extractable pigments livid purple (81) or dark purple (36); the tissue between perithecia grayish brown to brown, pithy to woody; the tissue below the

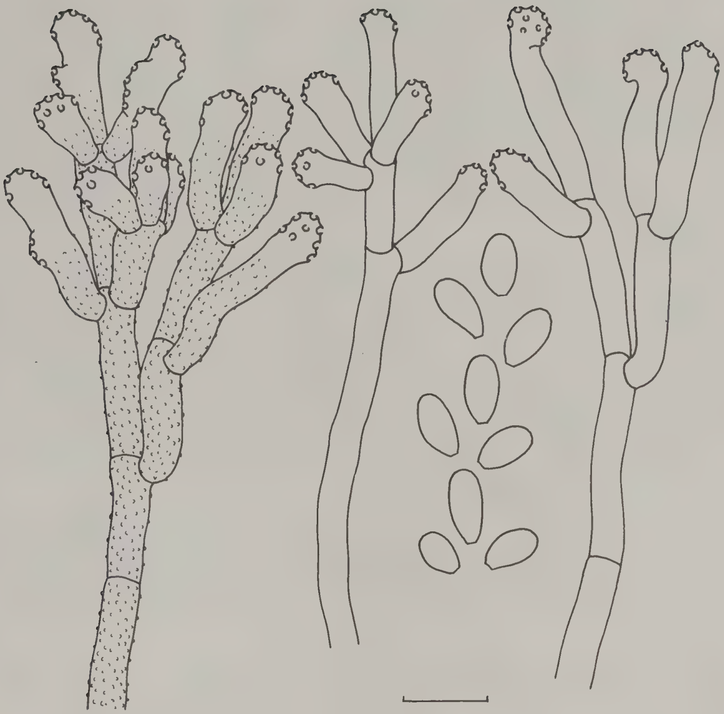


Fig. 3. ***Daldinia concentrica*** (Whalley 838). Conidiophores and conidia.

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perithecial layer composed of alternating zones, the darker zones dark brown, pithy to woody, 0.2-0.6 mm thick, the lighter zones brown, pithy to woody, persistent, 0.6-1 mm thick. Perithecia tubular, 0.3-0.5 mm diam x 1-2 mm high. Ostioles slightly papillate. Asci 210-250 µm total length x 8-11 µm broad, the spore-bearing part 75-90 µm long, the stipe 130-170 µm long, with apical ring bluing or not bluing in Melzer's iodine reagent, discoid or highly reduced, 0.5-1 µm high x 3-3.5 µm broad. Ascospores brown to dark brown, unicellular, ellipsoid-inequilateral, with narrowly rounded ends, 13-17 x 6-7.5 µm, with slightly sigmoid germ slit spore-length on convex side; perispore dehiscent in 10% KOH, smooth; epispore smooth.

HOLOTYPE: Bolton, J. 1789. A history of fungusses growing about Halifax III. Huddersfield. Illustrations on plate 180. SUPPORTING MATERIAL: U.K.: Captn Hope's Pleasure grounds, probably sent by Edward Robson to James Bolton, on stumps placed for seats (SUN).

EPITYPE: U.K.: England, Durham, Cassop Vale, V.1975, Whalley, A. J. S. 234, wood of ***Fraxinus*** (K).

OTHER SPECIMENS EXAMINED: U.K.: England, Cambridgeshire, Hailey Wood, VI.1982, Whalley, A. J. S. 838 (CULTURED), wood of ***Fraxinus*** (AJSW); Whalley 1, 2, 3, 4, 41, 59, 83, 85, 96, 111, 124, 154, 169, 172, 181, 187, 211, 230, 240, 243, 355, 377, 385, 399, 407, 447, 454, 465, 478, 486, 532, 582, 588, 603, 614, 638, 645, 665, 668, 670, 680, 700, 714, 752, 761, 792, 820, 828, 830, 834, 945, 946, 957, 1003 (CULTURED), 1005, no number (CULTURED). See Table 1 for the details of the specimens. A specimen listed in Ju et al. (1997) as ***D. petriniae*** is probably ***D. concentrica*** [UK: North Wales, Anglesey, vic. Menai Bridge, IV.1979, Whalley, A. J. S. & Rogers, J. D., wood (JDR)].

NOTES: ***Daldinia concentrica*** is constantly associated with ***Fraxinus*** and occasionally with other hosts. Both ***D. concentrica*** and ***D. petriniae*** yield purplish pigments in KOH and have similar ascospore size ranges. The latter differs in having a simple conidiogenous branching pattern—ranging from ***Sporothrix***-like to simple ***Nodulisporium***-like, in having conidia produced from percurrently proliferating conidiogenous cells, and in having broader conidia. Most specimens of ***D. concentrica*** that we have examined have the stromatal surface cracked into a fine network (Fig. 2). This feature has not been seen in ***D. petriniae***.

Most of the listed synonyms are based upon ancient material that either could not be located or was not sought. The Robson specimen, although highly important, is not considered an epitype because it apparently does not bear ascospores. We here select specimen Whalley 838 as the epitype of ***Sphaeria concentrica***.

The yellow-pigmented ***Daldinia***, accepted worldwide as ***D. concentrica***, is described as a new species. It has become so confused with ***D. concentrica*** in the current sense and some other taxa that a clean break with the taxonomic past seems desirable. It is thus named after Marion Child, the first great authority on ***Daldinia***.

Daldinia childiae J. D. Rogers & Y.-M. Ju, *sp. nov.*

Figs. 6, 27-29, 72 as ***D. concentrica*** in Mycotaxon 61: 243-293. 1997.

= ***Daldinia concentrica*** (Bolton: Fr.) Ces. & De Not. *f.* ***confluens*** C. G. Lloyd, Mycol. Writings 5, Large Pyrenomycetes: 24. 1919.

= ***Daldinia concentrica*** (Bolton: Fr.) Ces. & De Not. *f.* ***intermedia*** C. G. Lloyd, Mycol. Writings 5, Large Pyrenomycetes: 24. 1919.

= ***Daldinia concentrica*** (Bolton: Fr.) Ces. & De Not. *var.* ***minuta*** Waraitch, Indian J. Mycol. Pl. Path. 7: 16. 1977.

Stromata globosa, subglobosa vel turbinata, sessilia vel brevia stipitata, solitaria vel aggregata, tumulis peritheciorum inconspicuis vel conspicuis, 0.5-5.0 cm diam x 0.8-4 cm alta; externe brunneo-vinacea, castanea vel griseo-sepiacea, demum denigrata; sub superficie granulis armeniacis vel porphyreis conspersa, granulis isabellinis, avellaneis, melleis, succineis, vel cinnamomeis in KOH dissolutis; textura inter perithecia brunnea medullosa vel lignea; textura sub peritheciis zonis alternantibus composita, zonis fuscis medullosis vel ligneis, 0.2-0.6 mm crassis et zonis brunneis medullosis vel ligneis, persistentibus, 0.6-1 mm crassis praedita. Perithecia tubularia, 0.3-0.5 mm diam x 0.7-1.5 mm alta. Ostiola leviter papillata. Asci minimum 180 μm longitudine tota x 8-12 μm crassi, partibus sporiferis ca. 90 μm longitudine, stipitibus minimum 90 μm longitudine, annulo apicali in liquore iodato Melzeri cyanescente, discoideo, 0.5 μm alto x 3 μm lato. Ascosporae brunneae vel fuscae, unicellulares, ellipsoideo-inequilaterales, apicibus angustatis, 12-16 x 5.5-7.5 μm, rima germinativa recta, longa in latere convexo praeditae; perisporium in KOH dehiscens, leve; episporium leve.

Stromata globose, subglobose to turbinate, sessile or with short, stout stipe, solitary to infrequently aggregated, smooth or with inconspicuous to conspicuous perithecial mounds, 0.5-5.0 cm diam x 0.8-4 cm high; surface brown vinaceous (84), chestnut (40), or grayish sepia (106), darkened and dull in age; dull orange brown or dull reddish brown granules immediately beneath surface, with KOH-extractable pigments isabelline (65), hazel (88), honey (64), amber (47), or cinnamon (62); the tissue between perithecia brown, pithy to woody; the tissue below the perithecial layer composed of alternating zones, the darker zones dark brown, pithy to woody, 0.2-0.6 mm thick, the lighter zones brown, pithy to woody, persistent, 0.6-1 mm thick. Perithecia tubular, 0.3-0.5 mm diam x 0.7-1.5 mm high. Ostioles slightly papillate. Asci at least 180 μm total length x 8-12 μm broad, the spore-bearing part ca. 90 μm long, the stipe at least 90 μm long, with apical ring bluing in Melzer's iodine reagent, discoid, 0.5 μm high x 3 μm broad. Ascospores brown to dark brown, unicellular, ellipsoid-inequilateral, with narrowly rounded ends, 12-16 x 5.5-7.5 μm, with straight germ slit spore-length on convex side; perispore dehiscent in 10% KOH, smooth; epispore smooth.

SPECIMENS EXAMINED: FRANCE: Forêt Bugangue, VIII.1990, Rogers, J. D., (CULTURED), wood (WSP, HOLOTYPE); see all SPECIMENS EXAMINED listed as ***D. concentrica*** in Ju et al. (1997) for other specimen citations.

NOTES: ***Daldinia childiae*** is probably the most frequently encountered species in the genus. Most collections of this fungus have been identified as ***D. concentrica***. It differs from the latter in having isabelline, hazel, honey, amber, or cinnamon KOH pigments, in lacking fine network of cracks on the stromatal surface, and in having broader conidia produced from a ***Nodulisporium*** state with conidiogenous cells that usually proliferate sympodially. Conidial dimensions given in Table 1 of Ju et al. (1997) represent those of several species, including both ***D. concentrica*** and ***D. childiae***. Stromata of ***D. concentrica*** are usually larger and become black and varnished in age.

Hypoxylon simile C. G. Lloyd was listed in synonymy with ***D. concentrica*** by Ju et al. (1997). Its type specimen at BPI is from New Zealand and is in very poor condition. We thus hesitate in using this name to represent such a widely distributed species.

This paper, and the changes therein, make a new key to ***Daldinia*** necessary. It should be substituted for the key in Ju et al. (1997).

KEY TO TAXA OF *DALDINIA*[1]

1. Stromata known only from monocots 2

1. Stromata known from dicots, rarely or never from monocots 4

  2. Ascospores 8.5-11 x 4-5 μm; perispore dehiscent in KOH ...... ***D. bambusicola*** Y.-M. Ju, J. D. Rogers, & San Martín

  2. Ascospores larger; perispore indehiscent in KOH 3

3. Ascospores 15.5-18 x 6.5-7.5 μm, with germ slit spore-length ...... ***D. sacchari*** Dargan & Thind

3. Ascospores 20-26 (-30) x 7.5-9 μm, with germ slit much less than spore-length ...... ***D. graminis*** Dargan & Thind

  4. Stromatal pigments extracted in KOH dark mouse gray (119); perithecial mounds usually conspicuous; ascospores 10-11.5 x 4.5-5.5 μm ...... ***D. cuprea*** Starb.

  4. Stromatal pigments extracted in KOH other than above; perithecial mounds usually inconspicuous or lacking 5

5. Stromatal pigments extracted in KOH olivaceous, greenish, yellowish, or ochraceous [isabelline (65), hazel (88), honey (64), amber (47), or cinnamon (62)] 6

5. Stromatal pigments extracted in KOH dark livid (80), vinaceous gray (116), livid purple (81), vinaceous purple (101), livid violet (79), or lacking 8

  6. Lighter concentric zones of stromata brown, grayish brown, or, less frequently, whitish, pithy to woody, persistent; ascospores 12-16 x 5.5-7.5 μm; perispore dehiscent in KOH ...... ***D. childiae*** J. D. Rogers & Y.-M. Ju

  6. Lighter concentric zones of stromata whitish, gelatinous, disintegrating and, when dry, becoming loculate with locules separated by translucent membranous material; perispore dehiscent or indehiscent in KOH 7

7. Ascospores equilateral, slightly inequilateral, to, less frequently, inequilateral, variable, with broadly to narrowly rounded ends, 13-17 x 7.5-8.5 μm; perispore indehiscent in KOH ...... ***D. bakeri*** C. G. Lloyd

7. Ascospores strongly inequilateral, more or less uniform in shape, with narrowly rounded ends, 12.5-15.5 x 6.5-7.5 μm; perispore dehiscent in KOH ...... ***D. mexicana*** San Martín, Y.-M. Ju, & J. D. Rogers

  8. Lighter concentric zones of stromata brown, grayish brown, or, less frequently, whitish, pithy to woody, containing gelatinous material in younger stages of some species, persistent or becoming fibrous and loosening in some species 9

  8. Lighter concentric zones of stromata whitish, gelatinous, disintegrating and, when dry, becoming loculate with locules separated by translucent membranous material 19

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[1] This key is modified from Ju et al. (1997). Color codes in parentheses follow Rayner (1970).

9. Stromata depressed-spherical, sessile to subsessile, 3-5 mm diam x 2-4 mm high, with dark reddish brown surface; ascus apical rings highly reduced or lacking, not bluing in Melzer's reagent; ascospores light brown, ellipsoid-inequilateral to reniform, with broadly rounded ends, 9-11 x 4.5-5.5 µm, with straight germ slit much less than spore-length on more convex side; perispore indehiscent in 10% KOH .... ***D. singularis*** Y.-M. Ju, Vasilyeva, & J. D. Rogers
9. Stromata in various shapes and sizes; ascus apical rings bluing or, infrequently, not bluing in Melzer's reagent; ascospores with spore-length germ slit 10
    10. Ascospores equilateral, slightly inequilateral, to, less frequently, inequilateral, highly variable in shape, with broadly to narrowly rounded ends; perispore usually indehiscent or, infrequently, dehiscent in KOH 11
    10. Ascospores strongly inequilateral, more or less uniform in shape, with narrowly rounded ends; perispore always dehiscent in KOH 13
11. Ascospores 8-11 (-12) x 4-5.5 µm, with the germ slit usually on the less convex side .... ***D. caldariorum*** Henn.
11. Ascospores larger, with the germ slit usually on the more convex side ... 12
    12. Ascospores 11-14 (-15.5) x 6-8 (-8.5) µm .... ***D. loculata*** (Lév.) Sacc.
    12. Ascospores 14-22 (-25.5) x 7-11 µm .... ***D. grandis*** Child
13. Stromatal surface covered with ochraceous brown, polygonal scales; ascospores 12-16 x 6-7.5 µm .... ***D. lloydii*** Y.-M. Ju, J. D. Rogers, & San Martín
13. Stromatal surface lacking scales 14
    14. Ascospores 6.5-7.5 x 3-4 µm .... ***D. brachysperma*** San Martín, Y.-M. Ju, & J. D. Rogers
    14. Ascospores larger 15
15. Stromata turbinate to clavate, with a slender stipe less than 5 mm diam; ascospores 12.5-16.5 (-19.5) x 6-8 µm .... ***D. cudonia*** (Berk. & M. A. Curtis) C. G. Lloyd
15. Stromata sessile, subsessile, if stipitate, the stipe more than 5 mm diam 16
    16. Stromata cylindrical; ascospores 8-11.5 x (3.5-) 4-5.5 µm .... ***D. clavata*** Henn.
    16. Stromata other than cylindrical 17
17. Stromatal surface fairly smooth; ostioles obsolete, or slightly papillate; ascospores 10-14(-15.5) x 5-6.5 µm; conidia 4.5-6.5 x 2.5-3 µm; widespread in the tropics and subtropics .... ***D. eschscholzii*** (Ehrenb.: Fr.) Rehm
17. Stromatal surface roughened by papillate ostioles 18
    18. Stromatal surface frequently cracked into fine network; ascospores 13-17 x 6-7.5 µm; conidia produced holoblastically in sympodial sequence, (5.5-)6.5-8(-9) x 3.5-4.5 µm; known mainly on ***Fraxinus*** from Europe .... ***D. concentrica*** (Bolton: Fr.) Ces. & De Not.
    18. Stromatal surface usually not cracked; ascospores 12.5-16.5 x (6-) 6.5-7.5 µm; conidia produced from percurrently proliferating conidiogenous cells or, infrequently, from sympodially proliferating

conidiogenous cells, (5.5-) 7-9 x (4.5-) 5-6 (-7) µm; host range not established .... ***D. petriniae*** Y.-M. Ju, J. D. Rogers, & San Martín

19. Ascospores slightly inequilateral to equilateral, with broadly to narrowly rounded ends, 11.5-15.5 x 6.5-9 µm; perispore indehiscent or, infrequently, dehiscent in KOH .... ***D. fissa*** C. G. Lloyd

19. Ascospores strongly inequilateral, with narrowly rounded ends; perispore dehiscent in KOH 20

    20. Ascospores 22.5-30 x 8.5-10.5 µm .... ***D. macrospora*** San Martín, Y.-M. Ju, & J. D. Rogers

    20. Ascospores 12.5-15.5 x 6-7.5 µm .... ***D. gelatinosa*** Y.-M. Ju, J. D. Rogers, & San Martín

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Table 1. Specimens examined from A. J. S. Whalley's collections.

Specimen number	Species name	Area	Locality	Date	Collector	Host
1	***concentrica***	England	Devonshire, Slapton Wood	31.VIII.1967	Whalley, A. J. S.	***Fraxinus***
2	***concentrica***	England	Devonshire, Slapton Wood	31.VIII.1967	Whalley, A. J. S.	***Fraxinus***
3	***concentrica***	England	Devonshire, Slapton Wood	31.VIII.1967	Whalley, A. J. S.	***Fraxinus***
4	***concentrica***	England	Devonshire, Slapton Wood	31.VIII.1967	Whalley, A. J. S.	***Fraxinus***
41	***concentrica***	England	Devonshire, France Wood	IX.1967	Whalley, A. J. S.	***Fraxinus***
59	***concentrica***	England	Yorkshire, Forge Valley	23.IV.1968	Whalley, A. J. S.	***Fraxinus***
83	***concentrica***	England	Devonshire, Paignton	18.V.1968	Whalley, A. J. S.	***Fraxinus***
85	***concentrica***	England	Devonshire, Paignton	V.1968	Whalley, A. J. S.	***Fraxinus***
96	***concentrica***	England	Devonshire, Slapton Wood	20.V.1968	Whalley, A. J. S.	***Fraxinus***
111	***concentrica***	Wales	Gwynedd, Bangor, Gilfach	10.VII.1968	Whalley, A. J. S.	***Fraxinus***
124	***concentrica***	Wales	Gwynedd, Anglesey, Penmon Priory	22.IX.1968	Whalley, A. J. S.	***Fraxinus***
154	***concentrica***	England	Surrey, Box Hill	V.1969	Whalley, A. J. S.	***Fraxinus***
169	***concentrica***	England	Devonshire, Slapton Wood	VI.1973	Whalley, A. J. S.	***Fraxinus***
172	***concentrica***	Wales	Gwynedd, Anglesey, Penmon Priory	1.IV.1974	Whalley, A. J. S.	***Fraxinus***
181	***concentrica***	England	Devonshire, Slapton Wood	VI.1974	Whalley, A. J. S.	***Fraxinus***
187	***concentrica***	England	Devonshire, France Wood	VI.1974	Whalley, A. J. S.	***Fraxinus***
211	***concentrica***	Wales	Gwynedd, Bangor, Glyn Wood	IV.1975	Whalley, A. J. S.	***Fraxinus***
230	***concentrica***	England	Durham, Wilton-le-Wear Nat. Res.	16.V.1975	Whalley, A. J. S.	***Fraxinus***
234	***concentrica***	England	Durham, Cassop Vale	V.1975	Whalley, A. J. S.	***Fraxinus***
240	***concentrica***	England	Durham, Castle Eden Dene	V.1975	Whalley, A. J. S.	***Fraxinus***
243	***concentrica***	England	Cornwall, Carruggalt Wood	27.V.1975	Whalley, A. J. S.	***Fraxinus***
355	***concentrica***	England	Northants, Kettering	23.VI.1975	Whalley, A. J. S.	***Fraxinus***
377	***concentrica***	Wales	Gwynedd, Bangor, Glyn Wood	24.XII.1975	Whalley, A. J. S.	***Fraxinus***
385	***concentrica***	England	Hunts., Ravelly Wood	13.II.1976	Whalley, A. J. S.	***Fraxinus***
390	***loculata***	England	Durham, Great High Wood	3.III.1976	Whalley, A. J. S.	***Betula***
399	***concentrica***	Wales	Gwynedd, Bangor, Glyn Wood	17.IV.1976	Whalley, A. J. S.	***Fraxinus***
407	***concentrica***	England	Durham, Cassop Vale	25.IV.1976	Whalley, A. J. S.	***Fraxinus***
447	***concentrica***	England	Durham, Hawthorn Dene	22.X.1976	Whalley, A. J. S.	***Fraxinus***
454	***concentrica***	England	Durham, Hawthorn Dene	12.XI.1976	Whalley, A. J. S.	***Fraxinus***
465	***concentrica***	Wales	Gwynedd, Anglesey, Llanfair P. G.	27.XII.1976	Whalley, A. J. S.	***Fraxinus***
478	***concentrica***	Wales	Gwynedd, Anglesey, Llanfair P. G.	9.IV.1977	Whalley, A. J. S.	***Fraxinus***
486	***concentrica***	Wales	Gwynedd, Bangor, Glyn Wood	11.IV.1977	Whalley, A. J. S.	***Fraxinus***

—Table 1 continued—

532	***concentrica***	England	Durham, Hawthorn Dene	22.X.1977	Whalley, A. J. S.	***Fraxinus***
557	***loculata***	Scotland	Aniston Engine	21.VIII.1977	Watling, R.	***Betula***
582	***concentrica***	Wales	Gwynedd, Anglesey, Llanfair P. G.	27.XII.1977	Whalley, A. J. S.	***Fraxinus***
588	***concentrica***	Wales	Gwynedd, Anglesey, Llanfair P. G.	16.IV.1978	Whalley, A. J. S.	***Fraxinus***
603	***concentrica***	Wales	Gwynedd, Bangor, Britannia Wood	27.V.1978	Whalley, A. J. S.	***Fraxinus***
614	***concentrica***	Wales	Llangollen, Ty Ucha Farm	VII.1977	Whalley, A. J. S.	***Fraxinus***
638	***concentrica***	Wales	Clwyd, Ruthin, Gilygroes Wood	7.X.1978	Whalley, A. J. S.	***Fraxinus***
645	***concentrica***	Wales	Gwynedd, Anglesey, Plas Newydd	28.X.1978	Whalley, A. J. S.	***Fagus***
654	***loculata***	England	Ches., Thurstaton Common	5.XI.1978	Green, L.	***Betula***
664	***loculata***	England	Leics., Buddon Hill	22.IV.1978	Whalley, A. J. S.	***Betula***
665	***concentrica***	Scotland	Midlothian	VII.1978	Watling, R.	***Ulmus***
666	***loculata***	Scotland	Kintyre, Ardpatrick	1.VII.1976	Coppins, B. J.	***Betula***
668	***concentrica***	Scotland	Kintyre, Ardpatrick	20.X.1977	Gregory, S.	***Sorbus***
670	***concentrica***	Wales	Gwynedd, Anglesey, Llanfair P. G.	18.IV.1979	Whalley, A. J. S.	***Fraxinus***
680	***concentrica***	Wales	Gwynedd, Aber Falls	12.VI.1979	Whalley, A. J. S.	***Fraxinus***
700	***concentrica***	Wales	Gwynedd, Bangor, Britannia Wood	VIII.1979	Whalley, A. J. S.	***Fraxinus***
714	***concentrica***	England	Yorkshire, Denby Dale	XI.1979	Whalley, A. J. S.	***Fraxinus***
752	***concentrica***	Wales	Gwynedd, Bangor, Glyn Wood	29.VI.1980	Whalley, A. J. S.	***Fraxinus***
761	***concentrica***	England	Ches., Bidston Hill	25.X.1980	Issacc, S.	***Fraxinus***
792	***concentrica***	Wales	Gwynedd, Bangor, Britannia Wood	3.V.1981	Whalley, A. J. S.	***Fraxinus***
820	***concentrica***	Wales	Gwynedd, Bangor, Britannia Wood	24.X.1981	Whalley, A. J. S.	***Fraxinus***
828	***concentrica***	England	Jersey Channel Isles	II.1982	d'A Laholey, M.	***Fraxinus***
830	***concentrica***	Wales	Gwynedd, Bangor, Treborth	14.IV.1982	Whalley, A. J. S.	***Fraxinus***
834	***concentrica***	England	Lancs., Holland Moss	II.1982	Turner, R.	***Betula***
838	***concentrica***	England	Cambridgeshire, Hailey Wood	VI.1982	Whalley, A. J. S.	***Fraxinus***
945	***concentrica***	England	Ches., Delamere	28.XI.1982	Whalley, A. J. S.	***Fraxinus***
946	***concentrica***	Wales	Gwynedd, Bangor, Glyn Wood	30.XII.1982	Whalley, A. J. S.	***Fraxinus***
957	***concentrica***	Wales	Gwynedd, Aber Falls	31.XII.1982	Whalley, A. J. S.	***Fraxinus***
1000	***grandis***	England	Beds., Milton Keynes	XI.1983	Whalley, A. J. S.	***Ulmus***
1003	***concentrica***	Wales	Gwynedd, Anglesey, Church Island	11.II.1984	Whalley, A. J. S.	***Fraxinus***
1005	***concentrica***	Wales	Gwynedd, Bangor, Gilfach	11.II.1984	Whalley, A. J. S.	***Fraxinus***
No number	***concentrica***	Wales	Gwynedd, Bangor, Britannia Wood	I.1992	Whalley, A. J. S.	***Fraxinus***

Table 2. Tabular Comparison of ***Daldinia concentrica*** and ***D. childiae***

Characters	***Daldinia concentrica***	***Daldinia childiae***
Stromatal surface	Often with fine cracks	Usually without cracks
Stromatal color	Brownish at first, then black	Brownish at first, darkening
Stromatal pigment in KOH	Purple; sometimes lacking in old specimens	Yellow tones to cinnamon
Size	2-8 cm diam, often over 3 cm diam	0.5-5 cm diam, often not exceeding 3 cm diam
Ascospore size and shape	13-17 x 6-7.5 μm, ellipsoid-inequilateral	12-16 x 5.5-7.5 μm, ellipsoid-inequilateral
Perispore	Dehiscent in KOH	Dehiscent in KOH
Anamorph morphology	Typical ***Nodulisporium***	Typical ***Nodulisporium***
Conidia	Subglobose to obovoid to irregular, (5.5-)6.5-8(-9) x 3.5-4.5 μm	Subglobose to obovoid, 7-9(-10.5) x 4.5-5.5 μm
Culture growth rate	Covering 9 cm diam plate of oatmeal agar in 2 wk	Covering 9 cm diam plate of oatmeal agar in 2 wk
Colony surface after 3 wk	Appressed to tomentose. Tan to grey with green tones. Anamorph abundant	Appressed to tomentose. White, tan, to grey with yellow to greenish tones. Anamorph abundant
Reverse and agar color after 3 wk	Dull green	Dull brown with yellow to orange tones
Host range and distribution	Principally ***Fraxinus*** (see Table 1). British Isles and Europe. Not well-established	Very wide host range among dicot angiosperms. Temperate to tropical zones in both hemispheres. Known from Europe, but not known from British Isles

MYCOTAXON

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BOOK REVIEWS

Eric H.C. McKenzie, Book Review Editor

Resupinate Aphyllophorales of Tamil Nadu, India by K. Natarajan and K. Kolandavelu (1998). 133 pp., 240 x 160 mm. Centre for Advanced Study in Botany, University of Madras, Guindy Campus, Chennai 600 025, India. Rs. 200, US $30.

This book is a descriptive catalogue of 82 species of basidiomycete fungi within the order Aphyllophorales, which have resupinate fruit bodies, and which occur in the southern Indian state of Tamil Nadu. For convenience the authors define resupinate to include both effused and effused-reflexed types of fructification. Their basis for selection has therefore been on life form rather than on systematic grounds, since the species included are distributed among 47 genera in eight different families, several of which also have species with other forms of fruit body. All of the fungi selected have been previously reported elsewhere, and there are no new species listed, although two (*Kavinia globispora* and *Pachykytospora thindii*) were previously described as new species by the authors in earlier publications.

The purpose of the book is to provide a published record of poroid and non-poroid resupinate Aphyllophorales in Tamil Nadu. In this it clearly succeeds, since the authors indicate that only 11 species in their group have been previously reported from the state, and nearly half of the species listed are recorded from India for the first time. The value of the book is that it not only catalogues the associated voucher collections stored in Herbarium MUBL (Madras University Botany Laboratory), but also provides detailed descriptions, whereby those lacking access to the collections are still able to check the accuracy of the identifications in relation to species occurring in other parts of the world.

Although not stated, the book will also serve as a convenient reference text for those wishing to identify collections of resupinate basidiomycete fungi from different parts of southern India. In this respect, although technical terms are kept to an essential minimum, quite a number still feature, and a simple glossary would have been helpful to those less familiar with some of the terminology. A third objective has been to compare the distributions of the listed fungi between different countries in the tropics and subtropics. For this purpose Table 1 could have been arranged in a more convenient format to demonstrate the authors' conclusion that the resupinate Aphyllophorales flora found in Tamil Nadu is more akin to that of tropical Africa than to those of other regions in different parts of the tropics. How well have the mycofloras of each region been investigated, however, and would this conclusion still be supported if the pileate component of the order was also included? The authors make several other interesting observations based on their findings which imply that further study of basidiomycetes in less well-known tropical regions might significantly modify some of our present concepts with respect to fungal distribution. However, they do advise an element of caution with regard to the degree to which conclusions may be drawn from their data. How complete, therefore, is this work as a catalogue for Tamil Nadu? Only further collecting and study will indicate the extent to which it represents this group in southern India.

The structure of the book is arranged methodically. A short Introduction precedes the main body of the work, which consists of comprehensive macroscopic and microscopic descriptions, with accompanying line-drawn illustrations of microscopic characters, for each species. Descriptions are full, but devoid of superfluous detail, and are appropriate for identification or diagnosis. Brief collection data for voucher specimens, and references to any earlier records from India, are also supplied. The species are arranged in a logical, hierarchical order according to families and genera. Simple, practical keys are provided for each of the various families, genera, and species. At the end is a list of References and an Index to the genera and species, which usefully also includes synonyms referred to in the text.

A significant number of minor blemishes lessens the quality of the presentation. These include spelling or typographical errors (e.g., misspellings of *Junghuhnia crustacea*, p. 3; distribution, p. 14; subhymenium, p. 15; ellipsoid, p. 39; *Porogramme ravenalae*, p. 86; preliminary, p. 130; *Trametes*, p. 133, and so on), and inconsistency in the use of "Tamil Nadu" as either one or two words (title page versus elsewhere). *Pulcherricium caeruleum*, in the heading on p. 96, should be in italics. It is not explained why four species (*Grammothele setulosa*, *Kavinia globispora*, *Pachykytospora thindii*, and *Phellinus cereus*) are omitted from Table 1. Although detracting from the work, these imperfections do not affect its usefulness or overall thrust.

So, what does this book provide that is not already catered for by other related works such as those of Cunningham (1963), Bakshi (1971), Jülich & Stalpers (1980), and Ryvarden & Johansen (1980)? It presents new material which independently augments and complements the information in these publications. The instructive content and compact nature of this book make it a convenient collation for those interested in this particular group of fungi, whether for the identification of local collections, or more broadly for a knowledge of the mycoflora of southern India. It can therefore be recommended as a useful addition to the growing body of literature on tropical fungi in various parts of the world.

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Ryvarden, L.; Johansen, I. 1980: *A Preliminary Polypore Flora of East Africa*. Fungiflora, Oslo, Norway. 636 pp.

Ian Hood, New Zealand Forest Research,Private Bag 3020, Rotorua, New Zealand.

Monografia Illustrata del Genere* Russula *in Europa, Tomo Primo by Mauro Sarnari (1998). 799 pp. 240 x 170 mm. Orders: Associazione Micologica Bresadola, Via A. Volta, 46, I-38100 Trento, Italy. Lit. 100.000.

Russula is one of the most easily recognisable genera of ectomycorrhiza-forming agarics. Identification of species is often difficult and it is not made easier because of uncertainties with regard to nomenclature. Mauro Sarnari, who since 1984 has published nearly 40 papers on *Russula*, has set out to resolve these matters. In the preface to this volume, Bart Buyck writes that this book is neither a 'mere compilation of the author's previous publications nor is it a simple update of Romagnesi's monograph' which has been the only comprehensive account of the genus

Russula in Europe. Importantly, Sarnari has rigorously dealt with the nomenclatural problems throughout the genus.

There is a short introductory chapter on the genus, and a chapter outlining the contents of the taxonomic part of the book. An exhaustive discussion of the macroscopic and microscopic characters used for determination of species follows. This chapter also contains a chart of spore print colours found in European species of *Russula*. The next chapter discusses the ecology of *Russula* in Europe. There is a short chapter on nomenclature before the taxonomic treatment.

Sarnari's new systematic arrangement for the genus in Europe is discussed, after a comprehensive review of previous modern classifications of European *Russula* (Singer 1926, 1932, 1935; Romagnesi 1967; Bon 1988; Knudsen & Stordal 1992; Reumaux, Bidaud & Moδnne-Loccoz 1996). He recognises six subgenera: *Compactae* (Fr.) Bon (three sections), *Heterophyllidia* Romagnesi emend. (three sections), *Amoenula* Sarnari, *Ingratula* Romagnesi (four sections), *Russula* emend (six sections), and *Incrustatula* Romagnesi emend (two sections). There are significant changes over previous classifications with Sarnari describing one new subgenus, two new sections, four sections that are stat. nov., three new subsections, and two subsections that are stat. nov.

This first volume deals with the first four subgenera listed above plus section *Russula* of the large subgenus *Russula*. The other five sections of subgenus *Russula* and subgenus *Incrustatula* will be treated in a future volume.

The systematic treatment begins with the original diagnosis of the genus *Russula*, the type of the genus and a description of the genus. A synopsis of the genus follows. For each subgenus there is the original diagnosis and type, a description of the subgenus, and a list of sections, subsections, and series in the subgenus. Each section has the original diagnosis, type and description. This is followed by a description for each of the subsections/series. Notes on the subgenus follow this.

Keys to the subgenera, sections, and subsections are given in Italian and English. Each section/subsection has a key to species in Italian and English. A set of excellent colour plates of each of the species is located next to the key. Each plate is repeated next to the relevant species description.

For each species the type specimen is given (with lectotypification where necessary), the synonymy and the original diagnosis, the description, taxonomic notes, and often nomenclatural notes. There are at least two excellent colour plates for each species; subspecific taxa are also described and illustrated. Basidiospores and cuticular structure are illustrated in camera lucida drawings. I would have preferred to see scale bars on these drawings, but this is only a minor complaint. Regrettably there are no SEM photomicrographs of basidiospores. The species descriptions are meticulous and the colour plates a valuable aid to diagnosis.

A general index (contents) is at the end of the book followed by a taxonomic index. There is no bibliography in this volume; it is to be hoped that volume two will soon be published.

This beautifully illustrated book does justice to one of the most colourful macrofungal genera. This book is not only essential for those working on *Russula* in Europe but also for students of the genus everywhere. With Sarnari's nomenclaturally reliable monograph to aid them, it should now be possible for workers to start to clarify the taxonomy of *Russula* in the rest of the world and to determine the biogeography of the European taxa. This book is important for researchers like myself, working in countries where European names have been given to many species of *Russula*.

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Contributio ad Cognitionem Coprinorum by G. Cacialli, V. Caroti and F. Doveri (1999). 256 pp., 240 x 170 mm. Monografie di Pagine di Micologia. Tomo Primo. Orders: Associazione Micologica Bresadola, Via A. Volta, 46, I-38100 Trento, Italy. Lit. 25.000.

By writing this book, the authors have made a great advance in the study of the genus *Coprinus*. The book can be split into two parts — the main part consisting of references to literature, and of particular interest to mycologists who study the genus, and a smaller part in which there is a key, and description of all dung-habiting species found in Italy. The latter part is particularly useful to those beginning a study of *Coprinus* species and trying to give these a name. The choice of habitat is ideal for it is easily recognisable and the number of species is limited. Furthermore, many coprophilous species have a cosmopolitan distribution so the subject matter is of worldwide interest.

The publication starts (up to p. 26) with a list of authors and their publications. Authors are abbreviated with the first four letters of their names, each followed by three numbers which indicates the publication. Full publication details are then given. Pages 152-172 contain a list of all *Coprinus* species found in the literature, followed by the codename of the authors and article in which the species is described. It is thus easy to find the articles in question in the authors list. The literature references of journals and books are abbreviated, unless the title consists of only one word when it is given in full. An alphabetical list of abbreviations followed by the names of journals and books in full is added (pp. 27-32). The part 'Original diagnosis' contains the original description of all species given in the list (pp. 33-150), accompanied by some historical plates. The copy of the *Coprinus* section from *Nomenclator Fungorum* (1862) is very attractive (pp. 173-178). Literature concerning *Coprinus* finds in Italy is added in a separate list, followed by a list of literature consulted by the authors. In part 'Cartine' (pp. 183-204), distribution maps are given of *Coprinus* species found in Italy; this is mainly based on Italian herbarium material. It is somewhat indistinct in places and some old *Coprinus* names, rarely found in recent literature, are used. The last part (pp. 205-254) contains a key to the coprophilous *Coprinus* species found in Italy, accompanied by a full description and figures, but only of those species which were not published in earlier publications. This part is in Italian and in English. Where necessary and appropriate short English summaries are also given elsewhere in the book.

Although a number of species may have been missed, the list of species can probably be called complete. I compared the names with my own data and found about twenty extra names. However, in the library of the Rijksherbarium at Leiden I could not find descriptions with these names, so they could be misspellings or names belonging to other genera. Of course a number of small mistakes is inevitable. In the list of authors for instance insert: ADEM018 (Adema 1996). Under *C. kimurae* in the species list this reference is missing. In the literature list based on records in Italy is added ULJE021 (Uljé et al. 1998), which is a description of a new species from New Guinea! An important error in my opinion is the publishing of the new name *Coprinus bulleri* for *C. stellatus*. If *C. stellatus* is an invalid name, and I agree, then one must accept the validly described *C. brevisetulosus* (Arnolds 1982) as synonymous; the latter name is the correct name and a new name should not be presented.

This book can be used by the beginning *Coprinus*-lover for the naming of dung-inhabiting species. It is an attractive publication, and a good reference source for the *Coprinus* specialist. I am happy with it.

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Kees Uljé, Van Dijkstraat 21, 2405 XE Alphen a/d Rijn, The Netherlands.

Fungal Diversity. An International Journal of Mycology. Volume 1, August 1998; Volume 2, April 1999. Subscriptions: The Editor-in-Chief, Fungal Diversity Research Project, Department of Ecology and Biodiversity, The University of Hong Kong, Pokfulam Road, Hong Kong. US $100/year, institutional; $50 personal; $30 students. ISSN 1560-2745.

The second volume of this new journal has been recently issued. *Fungal Diversity* is aimed at an international audience and publishes papers in all fields of mycology. There are two volumes per year, and papers have been grouped under ecology and biodiversity, methods, molecular biology, ultrastructure, and systematics, with the latter containing the most papers. In addition, each volume contained two review papers. To date none of the papers have covered macrofungi, but these are obviously not precluded.

Each volume is fully indexed with fungal names and subject categories. There is also a listing of all new taxa and combinations. The first two volumes contained three new genera and 23 new species.

Fungal Diversity is published by The University of Hong Kong, Fungal Research Group. To date most of the authors have come from this Group. However, there are papers from other parts of the world, and contributions from other areas will no doubt increase as the journal becomes more well-known.

This journal is a high quality production and it is printed on glossy paper, thus allowing good resolution for photographs. It has a distinctive, bright yellow cover. It is a journal which must be consulted by all mycologists, especially systematists.

E. McK.

***Fungi of Northern Europe. Vol. 2. The genus* Lactarius** by Jacob Heilmann-Clausen, Annemeike Verbeken, and Jan Vesterholt. The Danish Mycological Society, Mundelstrup. 287 pp. ISBN 87-983581-4-6

This second volume in the series covers one of the more recognizable and commonly collected genera of fleshy fungi, *Lactarius*, and represents several years of cooperation between a Belgian mycologist, two Danish mycologists, and the Finnish mycological group. As a result, it blends the traditions of Nordic mycology laid down by E. M. Fries, P. A. Karsten, and J. E. Lange as well as those of Central Europe represented by J. B. F. Bulliard, L. Quelet, and H. Romagnesi. The result is a well-warranted and comprehensive work on a fascinating but difficult genus

After a brief, informative introduction, the value and importance of macroscopic and microscopic characters in the identification of taxa are described. The discussion of these features is accompanied by colour photographs of the latex, including colour changes on exposure to air, and scrobiculations on the stipe and cap as well as line drawings of basidiospore ornamentation, hyphal organization in the gill trama and hymenium, and pileipellis structure. This is followed by a brief outline of the infrageneric classification utilized by the authors along with comments on the ecology of *Lactarius* and notes on edible and poisonous taxa.

Each of the 97 species recognized by the authors from Northern Europe is described in detail along with one or more colour photographs accompanied by detailed line drawings. This volume is formatted with descriptions in the left facing page and photographs and line drawings on the right hand page. Beneath the specific epithets are listed the basionym, most important synonyms, misinterpretations, notations on the type, and an italicized summary of the diagnostic characters of each taxon. These treatments are invaluable and reflect the scholarly nature of the publication. This is followed by comprehensive descriptions which include important ecological and geographical data and are based almost exclusively on fresh specimens collected from different locations throughout northern Europe that were studied by the authors. The discussions, although informative, may be too brief for the professional mycologist truly interested in the northern European concept of taxa which might also occur in other northern latitudes around the world.

The series is designed to be comprehensive which means that all species, regardless of size or difficulty in identification, are included. Necessarily this means resorting to a microscope although plain language is used wherever possible and macroscopic features are used as much as practical. Although the Keys to Species are based largely on macroscopic characters, they include microscopic characters which some readers may find frustrating if they don't have a microscope. I was able to follow the keys readily as they seemed to be tried and true, authoritative keys based on original observations.

A list of the collections studied and illustrated is included as an appendix at the end of the text followed by "Colour References" compiled by the authors which refer to colour annotations and alphanumeric notations in Kornerup & Wanscher. This volume concludes with data on the geographical distribution of each taxon, based on published literature reports listed by the authors, a detailed list of literature on *Lactarius* in northern Europe, and a convenient index. The fact that the authors took the time to account for literature published by others, names in that literature, and confusion or resolution which results from the cited articles, speaks to the high quality of the work contained in this volume.

This book and the series in general are recommended for the serious amateur and all professional agaricologists as standard references and identification tools for all fungi from the northern latitudes.

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ERRATA

VOLUME SIXTY-TWO

Page 47, line 3	for *Spongiosos*	read *Spongiosus*
Page 48, line 43	for *Gloephyllum*	read *Gloeophyllum*
Page 92, line 12	for *Phaeographis*	read *Phaeographina*
Page 115, line 13	for *Angungitopsis*	read *Anungitopsis*
Page 131, line 1	for *M/H.-M.*	read *M. H.-M.*
Page 136, line 9	for *C.*	read *Cladosporium*
Page 147, line 21	for *devrisii*	read *devriesii*
Page 149, line 34	for *C.*	read *Cladophialophora*
Page 149, line 37	for *apud*	read *in*
Page 149, line 40	for *Kryptogemen*	read *Kryptogamen*
Page 153, lines 13-14	for *uniseptospoum*	read *uniseptosporum*
Page 205, line 19	for *Guzman & a;*	read *GUZMÁN & AL.*
Page 212, line 4	for *howewer,*	read *however,*
Page 215, line 17	for *of unknown*	read *for unknown*
Page 216, line 20	for *P. Beauv.: Fr.*	read *(P. Beauv.) Fr.*
Page 217, line 13	for *fruifing*	read *fruiting*
Page 217, line 20	for *to*	read *with*
Page 217, line 24	for *to*	read *with*
Page 217, line 32	for *to*	read *with*
Page 220, line 6	for *descompositrion*	read *decomposition*
Page 220, line 7	for *mediun*	read *medium*
Page 220, line 10	for *remainders*	read *remains*
Page 220, line 18	for *this*	read *these*
Page 252, line 24	for *M.*	read *Myracrodruon*
Page 260, line 12	for *M. urundeuva*	read *Myracrodrum urundeuva*
Page 290, line 1	for *bulbalinovelatus*	read *bubalinovelatus*
Page 349, line 8	for *tephanicola*	read *stephanicola*
Page 378, line 42	for *quercium*	read *quercuum*
Page 424, line 26, 30	for *Pluriseptatum*	read *pluriseptatum*
Page 428, line 17	for *colsely*	read *closely*
Page 436, line 6	for *Magnoliae*	read *magnoliae*
Page 438, line 2	for *reeat*	read *treat*
Page 439, line 13	for *sp. vov.*	read *sp. nov*
Page 443, line 4	for *Var.*	read *var.*
Page 448, line 18	for *form*	read *from*
Page 449, line 3	for *Characteristic*	read *characteristic*
Page 451, line 3	for *passiflora*	read *Passiflora*

ERRATA

VOLUME SIXTY-SEVEN

Spine	for	*April-June 1997*	read	*April-June 1998*

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